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ENGINEERING AND MINING JOURNAL

METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

McGRAW-HILL PUBLISHING COMPANY, INC. November 17, 1928 TWENTY-FIVE CENTS PER COPY

Ventilation of Long Tunnels

By Walter S. Weeks

The Porcupine Paymaster Project

By A. H. Hubbell

The Chino Concentrator

By E. H. Robie

Biographical Sketch of Heath Steele

By A. B. Parsons

Transportation of Gold and Diamonds by Airplane - by Owen Letcher

Fine vs. Coarse Grinding - - - - - - - - - - by M. Playford

The Debasement of Silver Coinage - - - - by W. Mont. Ferry

Flotation Problems Discussed by A.I.M.E. in Utah

Practical Notes on Mine, Mill, and Smelter Operation

When "Service" is More than a Word

[The following, concerning an I-R service engineer, appeared as an editorial in the Canadian Mining Journal, June 8, 1928]

A *"Tale of Common Things"*

THERE has lately come to our notice, by accident, a field report covering the span of one week in the life and doings of no less a person than Will Richards, who, as many of our readers will know, is a service man for one of our oldest mining machinery manufacturers. It is an epic in its way, and, because "service" is probably the most overdone word in the English language, we are not going to use it in connection with this episode, but, in reading the report over, we allowed ourselves the luxury of contemplating for a few moments the splendid esprit de corps existing between our mine operators and the men who build and install our mining equipment.

In these times, when railways are being pushed into our mining districts, when the various Provincial Governments are spending vast sums of money in roads, when motor boats, automobiles, and aeroplanes are available for travel, when the district that was remote yesterday is at our back door today, the obstacles mentioned in this report seem to belong to another day; but in this case the call came at the season when the "break up" was upon the land, and because the policy of cooperation can know no season or obstacles, Mr. Richards packed up his kit, and went, and this is what he did:

"Left Cobalt May 8th for Malartic District, stopped over in Cochrane for the night, left Cochrane May 9th, noon. Arriving Amos 4.30 P. M., stopped overnight at Amos, left for the mine May 10th. Drove 20 miles to Lake Malartic, stopped overnight at camp on edge of lake. May 11th crossed lake in a sled boat with one foot on ice and the other in boat, ice very dangerous. Walked nine miles to mine through swamps, crossed two rivers on rafts made with logs tied together with hay wire, water knee deep most of the way and only fell in twice, water very cold.

"Left customer well satisfied, machine is running nicely.

"My trip on the way out was the worst I ever experienced, could not cross lake, ice too rotten, had to walk around first day. Left camp Sunday, May 13th, at 9 A. M., walked 15 miles to Cash through bush, swamps, deadfalls and bush, water most places knee deep, arrived at Cash 7.30 P. M. Only had one ducking, stepped on log and it broke, let me in up to the arm pits, then had to walk five miles before I could get a change of clothes, which I had to borrow. Stopped one night here, left Cash on the morning of May 13th for another 10 miles, this was not quite so bad but hard walking, lot of swamp land and plenty of deadfalls.

"Arrived at first farm house 12.30, this put us around lake, had dinner, hired a rig and drove to Amos, which is about 20 miles. This section of country just in its freshet.

"Leaving Amos for Boston Creek, noon, May 15th."

This report seems to us an epic of energy and accomplishment and one must admire the fine spirit of teamwork which calls forth such willing efforts as a part of the day's work.

It is true that the word "service" has been sadly misused by many. Yet, Ingersoll-Rand continues to stress service to customers as a sales argument. Perhaps the above helps explain why we feel justified in doing this.

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The Interchange of Experience and Professional Ethics

PROFESSOR S. J. Truscott, president of the Institution of Mining and Metallurgy, in a statement to members recently issued, recalls the saying of a predecessor of his that "every man is a debtor to his profession." It is suggested that the debt can best be paid by contributing to the melting pot of knowledge those experiences and conclusions and records of success or failure without which no history is complete. There are compensating advantages to the writers, including the satisfaction of giving life to unborn ideas. The overcoming of difficulties and the solving of problems are creative works, maintains Professor Truscott, and all experience contains the elements of one or the other, or of both.

There is no greater waste than the waste of experience.

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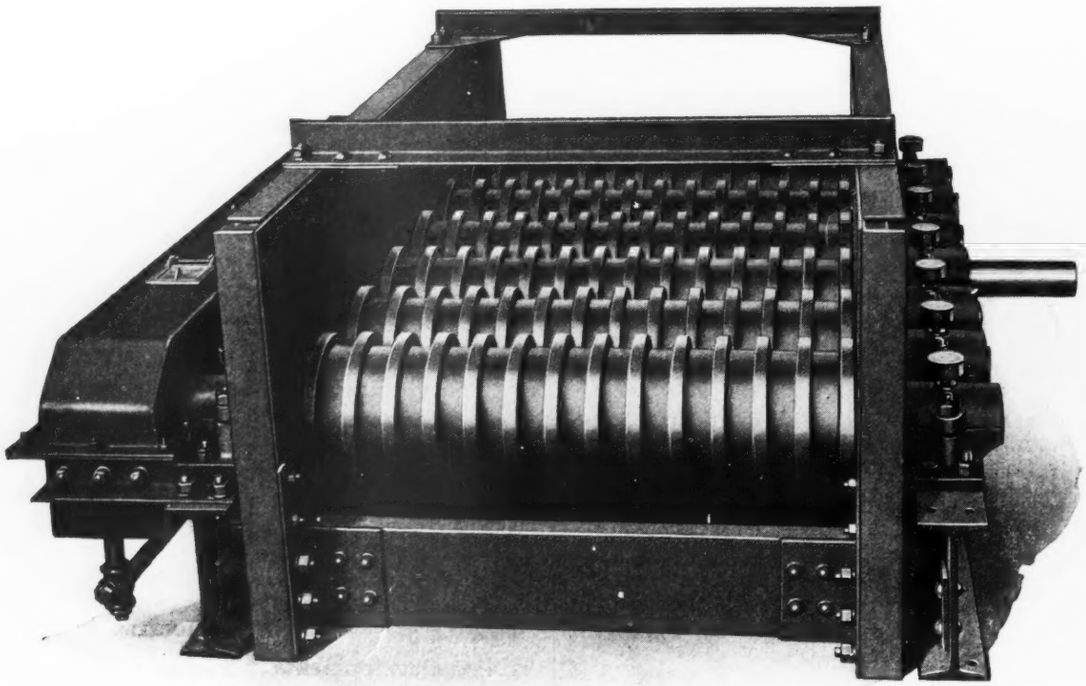

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McGraw-Hill Publishing Company, Inc.
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A. W. ALLEN,
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A Banker Challenges the Wisdom of an Old Adage

AT RARE INTERVALS one's attention is arrested, deflected from routine, by a statement or an analysis that provokes thought, challenges the narrow viewpoint, stimulates responsive appreciation. It is a privilege as well as the duty of an editor to give wider publicity to the outcome of constructive thinking of this character. And as we feel that every reader of *Engineering and Mining Journal* will benefit to some degree by heeding what is contained in the following excerpts from an address by Mr. Otto H. Kahn, delivered at the George Peabody College for Teachers, at Nashville, Tennessee, recently, we make no apology for a variation from customary practice. With a keen and mature knowledge of men and affairs, Mr. Kahn contends, by inference, that a shoemaker need not and should not stick to his last; that diversification of interest is as healthful and necessary for the mind as for the body. In addition to constructive value, the address is a model of clarity and an excellent example of the forceful and economical use of the English language. Mr. Kahn's comments follow:

Ours is a restless, purposeful, dynamic age. It is ceaselessly exploring, challenging, discovering, conquering, developing. At no period in history have changes been so rapid, so decisive and so far-reaching, of such vital effect upon the ways of living, the manners and concepts of the people, as they have in the last fifty years, and more particularly in the last twenty-five in this country.

One of the most characteristic changes and one of the most far-reaching in its effects upon the race is the increased amount of leisure, which, of late years, has come into the life of a large portion of our population, especially that of the working men. The significance of that development is accentuated by the abolishment of the saloon.

I need not point out to a body of educators the very great importance of the use which we make of our leisure hours. Dean Inge, the famous "gloomy dean" of England, did not exaggerate when he said recently: "The right use of leisure is no doubt a harder problem than the right use of our working hours. The soul is dyed the color of its leisure thoughts. As a man thinketh in his heart so is he." Apart from those lessons which we learn from our daily experience in the routine affairs of our existence and in our regular occupations, it is not too much to say that our individual development, the very contents of our lives, are largely influenced, if not determined, by the uses to which we devote that part of our time which is not absorbed by the demands of what government statistics term "gainful occupations."

As a matter of fact, I know no occupations more "gainful" in the truest sense of the word than those having no relation to mere monetary returns. To quote Dean Inge once more: "Every impersonal interest has a universal quality about it. It makes life as a whole worth more to us, and opens avenues which enlarge our minds."

Being given reasonably good health—and the use of our leisure hours has much to do, of course, with the making or marring of our health—I doubt if the world has ever known a time when such bountiful opportunities were available as there are now for making the life of the average man in the leading countries full and rich and interesting and stimulating, more especially in our own country.

I have been quoted in the press, recently, as saying that my "recipe for keeping young is overwork." That is not quite what I meant to express in the casual interview from which that sentence was culled. What I intended to advise is: intensity of work, multiplicity of interests, diversity of occupations. It is astonishing how much we can crowd into the waking hours of our day, without fatigue and overstrain, if we but vary our activities.

The one thing to avoid is to make machines of ourselves, to permit ourselves to sink into a state of sluggish, incurious, unimpressionable routine. The one thing that causes deadening fatigue is to use continuously one set of the "muscles" of our brain, and to use not at all, or altogether too little, the "muscles" of our soul. The thing to strive for is to keep keen our zest, broaden our interests, warm our sympathies, make responsive our sentiments for life and humankind.

Of course, there must be one chief occupation which commands our primary activity and principal energy. To scatter oneself over too many things, without concentrating pre-eminently on one or two, is to be a dilettante in everything one does, and proficient and effective in nothing. But, nevertheless, a saying two thousand years old, that "Nothing human is foreign to me"—which means: don't narrow your field of thought, feeling, and action; meet all sorts and conditions of people; touch life in many aspects—is still a maxim of both truth and practical wisdom.

Opportunity comes to everyone, however humble his circumstances, to enrich his life by partaking of its inner contents, by grasping, even though it be merely vicariously, its thrill, romance, and adventure.

To be sophisticated is not to be superior. To be blasé or cynical is not to be a philosopher. To be level-headed, even hard-headed, does not mean being "hard-boiled." To be a "snob" vis-a-vis of life, indicates—like being a social snob—lack of right feeling, of robustness, self-assurance, poise. To put all the eggs of your aims, interests, and occupations in one basket is not to be a good manager. To see life merely photographically is not to see it right, or to see it whole, because it does contain certain essential "imponderables" which no lens, other than that of our inner sight and understanding, can reproduce.

It has been said that "variety is the very spice of life." But it is much more than that. It is one of the very essentials of a correct diet of living, just as variety of food is an essential of a correct diet of nourishment.

As the soil of agricultural land requires rotation of crops to produce the best results, so does the soil of our inner being require variety of treatment in order to remain elastic and fertile, and to enable us to produce the best of which we are capable.

Mighty Oaks from Little Acorns Grow—Sometimes

A FEARFUL and wonderful document is the typical promotion report that carries none of the earmarks of a technical or engineering background. An appeal for funds from the "Eastern Stockholders' Committee" of the Premier Mines of Nevada, broadcast via the mails from Ann Arbor, Mich., is in this class. An examination of the property, one learns from this document, has been made by a "competent technical Mining Engineer," but who he is, and where the property is, are details that have escaped mention. The advantages and potentialities of the mines are summarized in optimistic terms. "No wonder," says the oracle, that "the engineer, in his technical report asserts: 'When one stops to consider the mining facilities of the average dividend-paying mine, he is astounded by the excess facilities available at this property (Premier Mines). But of course, *the real and mighty potential asset of Premier Mines is its known large tonnage of ore.* Thirty-nine assays taken in correct technical manner from the Lower and Upper Mines average $10.14 per ton in value.'"

The only mention of development work is contained in the caption under a picture of the portal of the main adit, which gives the information that "There are approximately 750 feet of tunneling, drifts, crosscuts, and upraises in these workings." The thirty-nine assays, from the 750 feet of workings, form the basis for plans that for sheer audacity have seldom been exceeded. When sufficient money at twenty-five cents per share has been collected, a mill of the "Flotation Process type" is to be erected, "to treat the Ore of the Mines of which there is an enormous tonnage now ready for mining for such treatment"—as indicated by the thirty-nine assays. The mill is to treat 250 tons per day for two years, or about 150,000 tons of ore at $10.14—the average of the thirty-nine assays. During this period the "Dividends per year for each $250 (1,000 shares) "will equal $410.00." The statement is made without qualification.

After the first two years the capacity of the mill is to be increased to 1,000 tons per day, and it is planned to continue mining $10.14 ore—as indicated by the original thirty-nine assays. This means the total treatment of over a million tons within five years after starting. For the three years after the first two years the "Dividends per year for each $250 (1,000 shares) invested" are given as "$1,882.66." This statement is also made without qualification. Finally, at the end of the prospectus, one reads: "Life of mines reckoned at thirty to fifty years, with increasing producing and earning capacity" —based, we presume, on the results of the aforementioned thirty-nine assays; with an inconspicuous reservation that "This compilation, while not guaranteed, is the result of careful estimates, which we believe will prove conservative in practice."

In the body of the appeal one learns that "The Secretary of the Committee was authorized by the Committee to visit the Mines and check up on all reports and statements, as well as the business affairs of the Corporation and its Management. . . . His report to us was a conclusive and final proof that Premier Mines is a real business proposition of huge proportions, that the affairs of the Corporation are efficiently and economically conducted, and that with a modern milling plant of adequate capacity to treat the Ore the Corporation should soon be able to pay very handsome profits to stockholders." Strange to relate, this statement is signed by the secretary of the company himself, who, we learn, is a professor on the faculty of the Department of English, College of Literature, Science and the Arts, of a prominent American university. This gentleman sends a subscription form, with the appeal "that you will fill it out for all you can afford," proffering the consolation that "you can be assured that you will receive your just proportion of any and all profits derived therefrom."

Two possible explanations of this weird and amateurish prospectus suggest themselves: The Eastern Stockholders' Committee is knowingly misrepresenting the situation in the hope of recouping for its members the "investments" they have already made; or the members of the committee are the dupes of some promoter who does not appear in the picture, but who is using the "prominent professional and business men" named in the prospectus as "window dressing" for a stock-selling scheme. Of the two, the latter seems the more probable, and it is certainly the more charitable explanation.

Estimating the prospective worth, if any, of an embryo mine is a problem calling for the highly specialized skill of a mining engineer—and he is not infallible. Many persons, including professors of English, would avoid recrimination and prevent a loss of the savings of others if they would confine their activities to matters about which they have at least a "fig-leaf" of knowledge.

Dowsing Versus Geology in Public Estimation

"OIL WITCHES" and "oil smellers," who manipulated peach twigs and went into trances to effect their ends in the early days of oil finding, were eventually routed by the "rock hound," "wrinkle chaser" and "pebble pup," as the petroleum geologist was at first derisively known, according to a pamphlet issued for the information of oil-company employees by the American Petroleum Institute. Fortunately the latter terms of endearment, once bestowed upon the geologist, are practically unknown today, their disappearance from common parlance demonstrating that the student of the earth and its rocks is now popularly recognized as at least a member of good society. Other instances may be cited of this evolution from crawling thing to *homo erectus:* the bone doctor is now an osteopath, the corn doctor a chiropodist, and both are asking higher fees. What's in a name or a title? Much, at times, provided one knows how to wear it.

Thus real merit tends to elevate its possessor in public esteem. But the apostle of the divining rod is still a dowser, whatever that may be, despite his occasional ardent champion, who generally proves to be a brother dowser. This brings to mind the doctrine of Vardamanism, which held the Negro race to be hopelessly inept because in Northern Africa it had been in contact with all the great civilizations of antiquity without achieving material advancement. Just so the dowser has been with us for generations, and has sunk rather than risen in the public eye. What following he still possesses is

to be found among the untutored and ignorant, such as the individual who recently inquired where he might purchase a "miner's earthing glass," which he had heard would enable him to look some distance into the ground. This, no doubt, if it really exists, is the device used by the gentleman who can see as far into a stone wall as anybody else. However, it is impossible to name a merchant who carries it in stock or a manufacturer who makes it. A fit tool for dowsing witches or witching dowsers it is, if one's hand can but be laid upon it.

Gold Producers and the Farmer Have Much in Common

THE FARMER must have relief, indeed, irrespective of political consideration. One must recognize that the state of his well-being has too important a bearing on the prosperity of the nation to be ignored. Continuance of the national prosperity is difficult to imagine if the large agricultural class suffers from financial difficulties. Everything possible should be done to insure to it a fair share of the wealth flowing into the pockets of other large units of the population. All that remains is to find a way to do it.

Surveying the agricultural situation of the last six years, the National Industrial Conference Board finds no fundamental improvement; and current indications warrant no expectations of such a change in the near future, it declares. Average prices (weighted) for 30 representative farm products at the farm have increased but 28 per cent in fourteen years, whereas the prices of the machinery, feed, fertilizer, and other goods used in production are 45 per cent higher on the average; the wages paid to farm hands are 68 per cent higher, and the cost of family maintenance is 58 per cent, taxes are 158 per cent, and interest on farm indebtedness is 66 per cent more than in 1914. These five items combined, according to the Conference Board, represent an increase of 65 per cent in the cost of farm operation.

The gold producer—particularly the quondam producer—surveys the agitation in behalf of the farmer with rueful interest. He, too, has suffered from increasing costs of labor and supplies. Unlike the farmer, he has received for his product not 28 per cent more than in 1914 but exactly the same price as then. Unlike the farmer in the aggregate, he has been unable to attract the attention of the general public to his plight, and even if he had succeeded, the public, neither eating gold nor understanding it, would have been mystified as to why anyone producing the precious metal should not be in affluence. His few champions in Congress failed to secure the passage of the bonus bill, apparently the only suggested remedy, and so he took the only possible course—he carried on until he could no longer do so. The few survivors are those who either have had an exceptional grade of ore, or else by means of improved large-scale operation have been able to reduce costs in spite of rising prices.

The gold miner's plight is the penalty exacted in periods of rising commodity prices from those who seek to produce the standard by which wealth is measured. To recoup his loss, or get his revenge, he must wait until prices fall once more, if haply he can survive or his reserves hold out. He apparently has a long wait ahead of him.

Physical Chemistry and Flotation Practice

FLOTATION in its infancy consisted of the interaction of oil, ore, water, and air, so as to yield—if fate so decreed—a valuable concentrate and a comparatively worthless tailing. Chemistry, as a science, was not then employed in applying the process or in extending its possibilities. Only within the last five years has organic chemistry been recognized as an important factor in flotation phenomena. The extensive use of thiocarbanilid, xanthates, and dithiophosphates affords ample evidence of such recognition, and only slight opportunity appears to offer for improvement in the flotation of sulphide minerals so far as the invention of new organic reagent compounds is concerned.

A better understanding of the physico-chemical relations in flotation, however, should do much to increase plant efficiencies, besides indicating new applications of the process. The preparation of the liquid vehicle, the oxidation of minerals, the solubility of minerals and gases in pulp, ionization, and solubility or catalytic changes in reagents—these are all important factors in the successful use of the flotation process and in extending its present field of application. Discussion of some of these phases of the art occurred recently at a joint meeting of local sections of the American Chemical Society and the A.I.M.E., held in Salt Lake City. The report of the meeting that appears elsewhere in this issue should be of timely interest, as aiding the dissemination of data and stimulating a deeper consideration of the fundamental phenomena underlying the operation of the process.

The James Furman Kemp Memorial Fund

A MEMORIAL that lives and by its very nature serves to continue the work that has been the chief endeavor of the person whom it commemorates cannot be surpassed. The proposal to establish, in memory of the late James Furman Kemp, a fund the income of which shall be devoted to research and publication in geology is highly fitting. No better way of continuing the life work of Professor Kemp could be devised.

Administration of this memorial fund will be in the hands of a committee on which the Institute, the Geological Society of America, the Society of Economic Geologists, and Columbia University will be represented. In selecting topics for research, preference will be given to studies in economic and structural geology. These were the fields in which Kemp made noteworthy contributions. All investigations, exploration trips or publications that may be supported by the fund will be so named as to indicate that they are part of the Kemp memorial.

As a teacher of his chosen line of economic geology Professor Kemp had few equals; in geological research he was among the pioneers. Above all things he was an educator—a kindly, lovable one—and it is eminently appropriate that through the proposed monument to his memory the quest for knowledge and its dissemination shall be carried on.

HEATH STEELE

A Biographical Sketch by A. B. Parsons

IT HAPPENED a few years ago that the subject of this sketch and the writer of it were each spending a month touring Mexico. Mr. Steele was making one of his periodical inspection trips to the properties of Cia. Minera de Peñoles, the American Metal Company's subsidiary of which he is president. I was visiting various mines, mills, and smelters. Our tracks happened to cross only once, but at all of the Peñoles properties I heard a great deal about Mr. Steele. The members of the staff — and frequently their families —either were looking forward to an impending visit from the president with pleasant anticipation, or they regaled me with accounts of recent social activities of which he had been the motif, and from which they were recuperating. A visit from New York officials always is an event in remote mining districts; it always entails a general overhauling and furbishing of the plant and the camp, and frequently the entire performance is regarded as a necessary evil. Mr. Steele's visits are the occasion for this sprucing-up process, but at the same time operating officials always are glad to see him and therein doubtless lies much of his success as an executive. Heath Steele started life about 44 years ago in Knoxville as an East Tennessee "hill-billy." His first mining experience was working for his father, who was at the time engaged in developing the zinc-blende deposits near Mascot, where the operations of the American Zinc, Lead & Smelting Company are now centered. For a time he was foreman of this work and later was assistant superintendent for the Blue Wing Copper Company in the Virgilina district, near the Virginia-North Carolina border. These and similar activities did not provide sufficient excitement for the young engineer. Accordingly, he set out to see the great West, selecting Goldfield, Nev., then at the height of its meteoric career as a high-grade gold camp, as a suitable destination. He arrived there early in 1897, and though he knew not a soul in the town he promptly got a job as a miner in the Combination mine. Later he worked in the Combination mill and cyanide plant as a battery man and solution man. Gradually he was advanced to positions of more importance in the employ of the Goldfield Consolidated Mines Company. Versatility apparently was one of his characteristics, for among other things he took charge of the mine offices and reorganized the cost-accounting system. At this time, J. R. Finlay spent a year at Goldfield as general manager for the Consolidated. Mr. Finlay made him inspector of mines and put the entire surface operations at the mines in his charge. When Mr. Finlay left Goldfield, Heath Steele went with him as assistant in the appraisal of the iron and copper mines of Michigan for the State Board of Taxation. After finishing this large assignment, he continued to be associated with Mr. Finlay in general consulting practice in New York for several years. In October, 1917, on Mr. Finlay's recommendation, he became assistant to Dr. Otto Sussman, vice-president in charge of operations for the American Metal Company. One of his outstanding achievements was the thorough reorganization of the operations in Mexico of the Cia. Minera de Peñoles. The company had mines and smelters scattered in many parts of Mexico, but the management was decentralized. Mr. Steele established headquarters in Monterey, and at the end of three years had perfected a smooth-working and efficient organization. About two years ago Mr. Steele was made vice-president in charge of operations of the U. S. Metals Refining Company, the subsidiary that owns the copper smelter and refinery at Carteret, N. J. In this capacity he has directed the recent campaign of modernization and expansion that has transformed the Carteret unit into a highly efficient plant. He also is the president of the American Metal Company of New Mexico, the subsidiary that operates the Pecos lead-zinc mines, which recently were equipped with a new concentrator and put

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HEATH STEELE

(Continued on page 781)

Theory and Practice in the Ventilation of Long Tunnels

By WALTER S. WEEKS
University of California, Berkeley.

THE ventilation of a long single-entry tunnel, during the period in which it is being driven, is a problem of great interest. On account of the large amount of capital tied up in the enterprise, speed is paramount. The places where advance can be made are restricted to the headings, so obviously it is necessary to work every moment that is possible. To multiply working places and so increase speed, shafts are often sunk

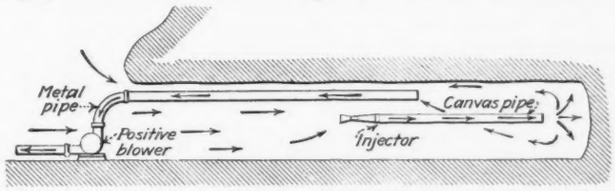

Fig. 1—Air currents in tunnel when exhausting smoke

on the line, and two headings advanced from each shaft, as well as from the portal or portals. At times shafts are out of the question, and long tunnels must be driven, each with a single heading.

The chief problem in the ventilation of such a tunnel is the rapid removal of powder smoke after the blasting, so that work can be resumed soon after the round is fired. After firing, the smoke is concentrated in a zone near the breast, and conditions are favorable for drawing this smoke into the end of the ventilating pipe, which is kept as close to the breast as flying rocks will permit.

The zone between the end of the pipe and the breast is a dead air space, and special means must be employed to drive the smoke from this space back to the ventilating pipe. A method commonly used is to turn on the compressed air at the breast. The volume of air available is seldom sufficient to flush the place properly, and the high-velocity jet stirs up a lot of dust. A better method is to place an air injector about 15 ft. back of the end of the ventilating pipe, and drive air to the breast through canvas tubing. The volume of air sent to the breast must be controlled so that the smoke does not short-circuit through the injector. Air currents set up when the system is in operation are shown in Fig. 1. The air injector, shown in Fig. 2, uses about 60 cu.ft. free air per minute when the gage pressure is about 80 lb. per square inch.

A tight wire can be anchored behind a timber near the breast and the canvas tubing, equipped with rings to run on the wire, can be pulled to the breast. I have tried blowing it to the breast, but have never succeeded. A simple method is to equip one man with a gas mask and have him stretch the tubing. Even if the men of the crew take it in with them they would be in the smoke only until the injector is started.

In long tunnel work the positive blower is used almost entirely, because the pressures encountered are usually beyond the range of the centrifugal fan. The Roots blower is an example of the positive blower, which traps the air on the intake side and forces it through the blower against the resisting pressure. The impellers are always pushing against the constant pressure, so the horsepower consumed by the blower is

$$\frac{\text{Displacement in cu.ft. per min.} \times \text{pressure in lb. per sq.ft.}}{33{,}000 \times \text{Mech. Eff. of Blower}}$$

The blower does not deliver a volume of air equal to the displacement, because some space must be left between the impellers so that they do not rub. Air leaks back through these spaces and between the impellers and the casing; and the higher the pressure, the greater the leakage. This leakage is expressed in terms of revolutions per minute in the following manner:

A blower is operated with a closed discharge against a desired pressure, and the number of revolutions per minute determined that will just hold the desired pressure. All the air that the blower is handling leaks back through the clearance spaces. This speed is known as the slip speed.

The running speed of the blower minus the slip speed is the effective speed of the blower. The air delivered is the effective speed multiplied by the displacement per revolution.

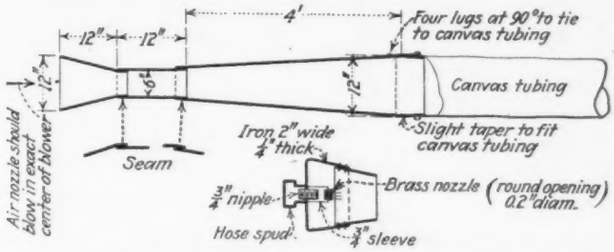

Fig. 2—Compressed air blower or injector, of 20-gage galvanized iron

Direction of the flow of air in the pipe may be controlled by means of a four-gate system, which permits connecting the pipe to either the inlet or discharge of the blower, and opening either the inlet or discharge to the atmosphere.

The air current may also be reversed by reversing the blower. Such an arrangement is more compact and eliminates leakage around the gates. If it is to be used and the blower is of the Roots type, the impellers must be adjusted so that they do not rub when running in either direction. This adjustment results in increased clearance

and greater slip speed, which must be considered in selecting the blower.

The blower selected should be suited to its duty and must be built to stand the maximum pressure to be encountered. It should have relief valves for both positive and negative pressure, so that, in case the ventilating pipe is stopped up, the pressure developed will be limited. No pains should be spared in the installation of the blower on a concrete foundation so that it will run during the period of driving without shutdown.

The blower should always be placed outside of the tunnel, where it can be cared for by the compressor man. If a blower will stand the maximum pressure necessary, no advantage can be gained by placing it in series with other blowers. An illusion sometimes produced, that more air is delivered by placing a second blower somewhere in the tunnel, is caused by the fact that most of the air from the first blower is lost through avoidable leaks, and the second blower takes air out of the tunnel through leaks and drives it to the breast.

The maximum rate of air flow is determined by the amount that must enter the pipe when smoke is being exhausted. During the blowing period it is necessary to blow in only enough air to keep the air pure; 50 cu.ft. per man per minute is sufficient. If the end of the ventilating pipe is so far from the breast that air does not reach it, the air is relayed to the breast with the injector and canvas tubing. If the tunnel is hot, the men can be cooled at slight expense by turning the injector on full.

During the exhaust of powder smoke it is desirable to draw out each minute a volume of air in cubic feet equal to 30 times the area of the tunnel. In large tunnels it would be impossible to circulate this amount without the use of unduly large pipes. I would place the minimum requirement at ten times the area of the tunnel. This means that, if the area of the tunnel is 100 sq.ft., at least 1,000 cu.ft. per minute must enter the ventilating pipe when the tunnel has advanced to its farthest point. At all other periods in the driving a greater volume will be circulated.

The blower must be selected to cause the desired volume of air per minute to enter the pipe when the heading has advanced to the end of the proposed line. Consequently, a negative pressure must be maintained at the blower equal to the frictional loss in the line. Inasmuch as the pressure at the blower is lower than the pressure at the end of the pipe, a larger volume must be taken out than that which goes in. Inaccurate estimation of this increase in volume will cause a failure of the system.

The pressure decreases and the velocity increases as air flows through the pipe. These variations are taken into consideration in the following conservative formula, which is suitable for this type of calculation:

$$p_1^2 - p_2^2 = \frac{0.0006 Q_s^{\,2} L}{d^5}$$

p_1 = Initial pressure in pounds per square inch absolute.
p_2 = Final pressure in pounds per square inch absolute.
Q_s = Cubic feet of air entering the pipe each minute measured at 14.7 lb. per square inch.
L = Length of pipe in feet.
d = Inside diameter of pipe in inches.

Introduction of a specific problem will now be useful:

A tunnel has a cross-sectional area of 100 sq.ft. The barometric pressure is 12 lb. per square inch. The tunnel is to be 10,000 ft. long and is to be ventilated with 12-in. diameter pipe. The problem is to select the blower and determine its speed, the displacement of the blower per minute, the horsepower of the motor, and the gage of the pipe at all points in the tunnel. Attempt will be made to exhaust a volume each minute equal to 20 times the area.

$20 \times 100 = 2{,}000$ cu.ft. per minute.

This entering air is at 12 lb. per square inch.

$$Q_s, \text{ the volume at } 14.7, = \frac{12}{14.7} \times 2{,}000 = 1{,}633.$$

The initial pressure at the end of the ventilating pipe is 12 lb. per square inch, the barometric pressure; p_2, the pressure at the blower, is to be determined when the pipe is 10,000 ft. long.

$$(12)^2 - p_2^2 = \frac{0.0006 \times (1{,}633)^2 \times 10{,}000}{(12)^5}$$

$$p_2 = 8.93$$

Negative pressure at blower $= 12 - 8.93 = 3.07$, or, say, 3.1 lb. per square inch.

The blower must be strong enough to exhaust the air when the pressure in the pipe is 3.1 lb. per square inch below the atmospheric pressure.

A blower is selected, tentatively, with a displacement per revolution of 10 cu.ft. and a maximum speed of 350 r.p.m. Assume that the slip speed when working at a pressure of 3.1 lb. per square inch is 50 r.p.m.: The absolute pressure at the blower is 8.93 lb. per square inch; so, if 2,000 cu.ft. per minute at a pressure of 12 lb. per square inch is to enter the pipe, the volume removed at the blower must be

$$\frac{12}{8.93} \times 2{,}000 = 2{,}686$$

The effective speed of the blower is

$$\frac{2{,}686}{10} = 269$$

The running speed is the effective speed, plus the slip speed, or $269 + 50 = 319$ r.p.m.

The displacement of the blower per minute is 3,190 cu.ft. per minute. The horsepower of the motor is

$$hp. = \frac{144 \times 3.1 \times 3{,}190}{33{,}000 \times 0.90} = 48 \text{ hp.}$$

Assume that the blower is equipped with a 50-hp. motor. If the blower is reversed, so that it blows air into the pipe, the blower is attempting to force to the breast about 2,690 cu.ft. air per minute at 12-lb. pressure. It will be seen that the power requirement is greater than 50 hp.

$$Q_s = \frac{12}{14.7} \times 2{,}690 = 2{,}196$$

$$p_1^2 - (12)^2 = \frac{0.0006 \times (2{,}196)^2 \times 10{,}000}{(12)^5}$$

$$p_1 = 16.13$$

$$p_1 - p_2 = 16.13 - 12 = 4.13$$

$$\text{Horsepower} = \frac{4.13}{3.1} \times 48 = 64 \text{ hp.}$$

The large amount of air the blower could deliver, if the motor were large enough, is not needed.

Air can be regulated by using a variable-speed motor or by blowing some of the air to atmosphere at the blower. If the motor is selected to care for the exhausting period, its capacity will not be exceeded if no larger volume per minute is allowed to pass into the pipe during the blowing period than was drawn into the pipe during the exhausting period. A mercury manometer on the pipe at the blower will indicate the pressure, and in this problem the pressure must not rise above 3.1 lb.

per square inch. The waste-air gate may be set so that this pressure is not exceeded.

If power is paid for at metered rate, a variable-speed motor would probably be more economical. If power is

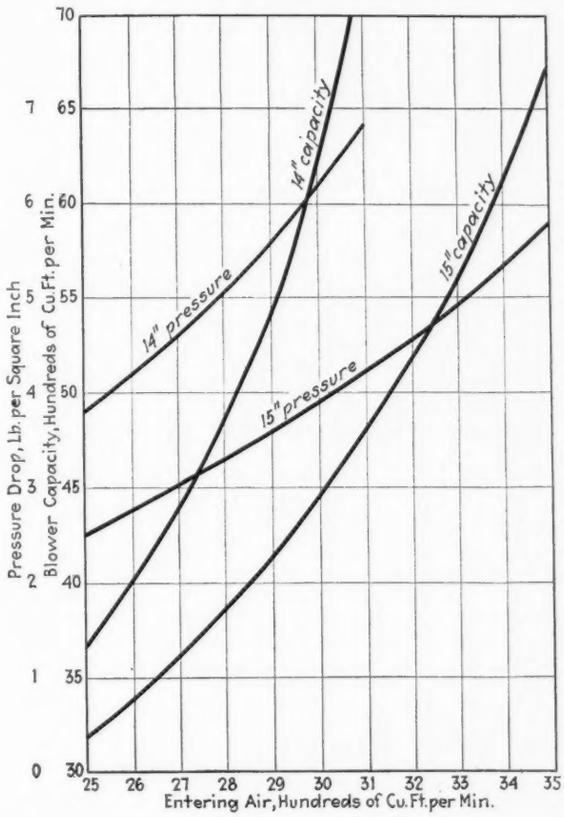

Fig. 3—Curves showing rate of inflow for different values of effective capacity

paid for according to connected load, the waste-air method would be cheaper, because the constant-speed motor would be cheaper.

The pipe line must be absolutely tight and must not collapse with the maximum negative pressure to which it will be subjected. At present the sheet-metal pipe is the best pipe available. Slip joints cannot be made tight. The best joint, in my opinion, is made by turning out the ends of the pipe about ½ in. and placing loose iron flanges with bolts on the pipe. Heavy roofing paper makes a good gasket. This is squeezed between the turned-up edges of two adjoining pipes by the iron flanges.

The maximum negative pressure at different points in the pipe line must next be determined. Sufficient accuracy is obtained by considering drop in pressure as proportional to length. The negative pressure at different distances from the blower when the maximum length of pipe is in use would be as follows:

Distance From Blower, Ft.	Pressure, Pounds per Square Inch
0	3.10
2,000	2.48
4,000	1.86
6,000	1.24
8,000	0.62
10,000	0.00

Data on the resistance of sheet-metal pipe to collapse are given in the table presented at the top of the next column.

The selection of pipe will depend on the factor of

Behavior of Sheet Metal Pipe Under Vacuum

Pressures are below atmospheric in pounds per square inch (a).

Diameter, Inches	Gage	Noticeable Distortion	Collapse
12	22	1.0	3.0
12	20	1.0	3.5
12	18	2.5	7.5
15	20	1.5	3.0
15	18	2.5	4.5
15	16	3.0	7.5
15	14	6.0 uncollapsed at	10.0

(a) "Collapse of Metal Ventilating Pipes," W. S. Weeks, *Engineering & Mining Journal-Press*, March 27, 1926.

safety used. Distortion begins at about one-third of the collapsing pressure, so it is well to use a factor of safety of three. If this factor is used, 16-gage pipe should be used for the first 2,000 ft.; 18 gage from 2,000 to 6,000; and 20 gage from 6,000 to the end. A smaller gage could be used near the end if desired. One might "get by" with a factor of safety of two, but the pipe would be distorted when exhausting. It is good practice to place a length of heavy pipe at the end of the line. Its open end should be covered with a coarse screen. This length is advanced when a new length of pipe is put on.

One more problem may present itself in tunnel ventilation. A number of blowers of fixed displacement per minute are available, and it is desired to know how much air each would cause to enter the pipe when the tunnel has advanced to its farthest point.

Such a calculation cannot be made directly, because the rate of inflow cannot be determined until the pressure at the blower is known, and the pressure at the blower cannot be determined until the rate of inflow is known. The problem can be solved by assuming different rates of inflow, calculating the drop in pressure, and finally the rate at which air must be removed at the blower. A curve of the results is plotted. Such curves for 14- and 15-in. pipe are shown in Fig. 3, plotted for an actual tunnel, not the one in the problem. The effective displacement per minute is selected, and the rate of inflow determined from the curve. The pressure at the blower is determined from the pressure curve.

Economics is the final arbiter of the combination of pipe and blower that is to be used. Several combinations that will do the work should be designed, and the cost for ventilation per foot of tunnel should be computed.

Finally, the operation of the ventilating system should be placed in charge of one man, solely responsible for the tightness of the line, the installation of pipe at the proper time, and the placing of the air injector. Any system left to the mercies of the heading crew will disintegrate.

Heath Steele—Biographical Sketch

(Continued from page 778)

into profitable operation. As to Mr. Steele's hobbies, he is said to be an ardent fisherman, a successful duck hunter, and an erratic golf player. He has a splendid home at Plandome, Long Island, a feature of which is an extensive greenhouse. Here he spends a great deal of time and energy raising flowers of many varieties. That he has had good luck is indicated by the fact that his flowers have won prizes at various exhibitions.

Heath Steele is a competent engineer, but his success lies principally in his ability as an administrator; and the secret of this, one suspects, is explained by the chance remark of one of his associates, "Every man in the organization is 100 per cent 'for' him." That is a tribute which is full of significance.

Notes on the Chino Concentrator

Part XIX: Revisiting Arizona Mining Camps

By E. H. Robie
Associate Editor

MY JOURNEY from Ajo to the Chino plant at Hurley, N. M., was broken by a stop-off of a few hours in Tucson, where I enjoyed the hospitality of G. M. Butler, dean of the College of Mines and Engineering at the University of Arizona and Director of the Arizona Bureau of Mines. The campus is most attractive, and the physical equipment of the university, so far as I saw it, seems unusually good. A virile mining school is growing up here, with plenty of opportunity for observation of practical work on every hand. I can well understand why the university has already attracted 2,000 students a year, for, in addition to the scholastic opportunities it affords, living expenses are reasonable, and those who enjoy an outdoor life have peculiar advantages here.

Tucson is the oldest continuously occupied town in the United States, the indications being that it was settled about the year 900, though this fact is not generally known. On the hillside west of the site of the present city are many evidences of Indian occupation, including holes in the rock three or four inches in diameter and two or three times as deep, in which corn was ground. The San Xavier Mission, 10 miles south of Tucson, should not be missed by any traveler in that region. It was founded about 1690 and is said to be the largest, most complete, and interesting old mission in the country. It is still a religious center as well as an object of interest to the sightseer; truly an absorbing place, and Dr. Butler was a wonderful guide.

A great many of the people in Tucson are said to be there for their health. Some of those one meets on the street are plainly sick, but the general appearance of the populace is healthy and happy.

Among the conveniences enjoyed by the residents of Tucson is an excellent airplane service to both Phoenix and Los Angeles. The passenger rate to the Coast is but $35, which is just about the same as the railroad rate if one includes Pullman charges and meals; many hours of time are saved, of course. In the East, the air rate is two or three times that by rail, but air passengers on the Coast are more fortunate. This mode of travel is certain to be vastly expanded, especially where the rail service is bad. An aërial route south from Salt Lake City to Arizona points would seem to be very much in order, to connect with the present service from Salt Lake to Great Falls, Mont. It would be especially convenient for mining engineers.

My destination, after leaving Tucson, was the Chino concentrator at Hurley, in the adjoining state of New Mexico, which necessitated my leaving the train at Deming, and taking the 10 o'clock stage, arriving at Hurley shortly before noon. The afternoon was left for a walk through the concentrator.

The Santa Rita del Cobre mine, at Santa Rita, near by, was opened by Spaniards in 1804, but steam and electric shovels have since eliminated all trace of the early workings. Unfortunately, time did not permit my viewing this feature of the company's activities, all of which is open-pit mining. One 84x66-in. jaw crusher and one 66x48-in. in size, installed at the mine, break all ore to about 10 in., at which size it is shipped 9 miles to the concentrating plant. The important copper mineral is chalcocite, with minor amounts of cuprite and occasionally a little native copper.

The flow sheet of the concentrator has been much simplified over what it was a few years ago. Crushing is first performed in a Symons cone crusher, followed by rolls; and a rod mill, followed by ball mills, in closed circuit with bowl classifiers, prepares the pulp for flotation. Thickening and filtering of the flotation concentrate

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Map of Arizona, on page 783, showing mining towns, highways and railroads

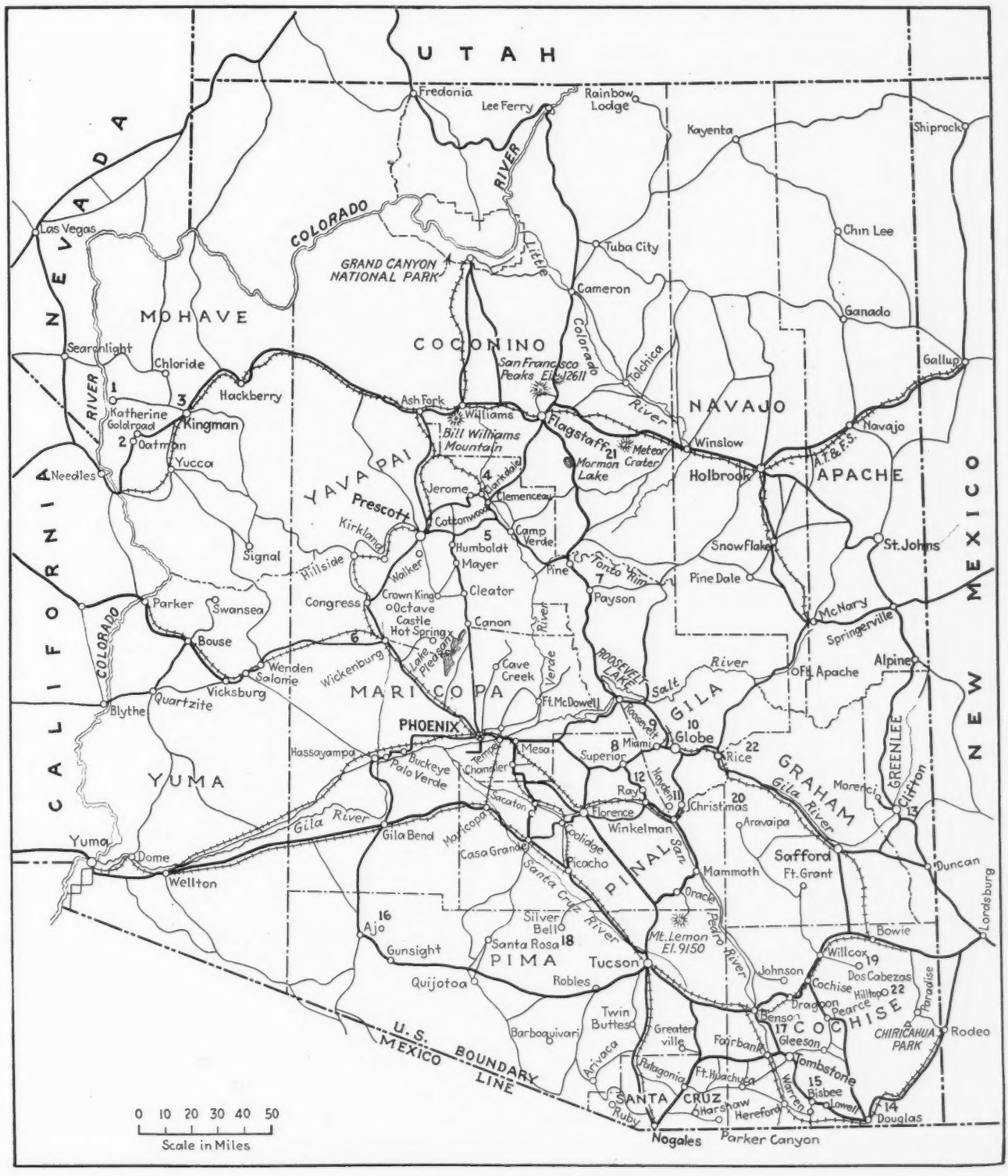
1. Katherine Gold Mining Company
2. Tom Reed Gold Mines Company, United Republic Gold Mining Company
3. Old Colony Mines, Ltd., Chloride Mining Company
4. United Verde Copper Company, United Verde Extension Mining Company, Verde Central Mines, Inc.
5. Southwest Metals Company, Crown King Milling & Reduction Company
6. Tonopah Belmont Development Company, United Vanadium Corporation, Tindale Mining Company, Sonora Development Company
7. Triangle Asbestos Company, Arizona Cinnabar Company
8. Magma Copper Company, Belmont Copper Mining Company
9. Inspiration Consolidated Copper Company, International Smelting Company, Miami Copper Company
10. Old Dominion Company, Arizona Commercial Mining Company
11. Nevada Consolidated Copper Company, mill; American Smelting & Refining Company, Christmas Copper Company, Hope Metals Company
12. Nevada Consolidated Copper Company, mine
13. Phelps Dodge Corporation, Morenci branch
14. Phelps Dodge Corporation, smelter; Calumet & Arizona Mining Company, smelter; Arizona Gypsum Company
15. Phelps Dodge Corporation, Copper Queen branch; Calumet & Arizona Mining Company, Shattuck Denn Mining Corporation, Night Hawk Leasing Company
16. New Cornelia Copper Company
17. Bunker Hill Mines Company, Tombstone; Keystone Copper Mining Company, Dragoon
18. El Tiro Copper Company
19. Central Copper Company
20. Aravaipa Mining Corporation
21. Meteor Crater Exploration & Mining Company
22. Regal Asbestos Mines, Inc.

completes the process. Tables are not used except when native copper appears.

Of chief interest at the Chino plant during the last year or so has been the installation of the Symons cone crusher, this being the pilot installation of this machine in the Jackling group of mills. So successful has it been that, based on the Chino results, the manager of one of the country's largest concentrating plants told me that a saving of 1¼c. per ton was indicated in his mill by the installation of a cone crusher for secondary crushing to ¾ in. instead of using rolls.

The Symons cone crusher installed at Chino is a 7-ft. machine made entirely of cast steel and weighing only 60 tons, which is light considering its capacity. It was installed early in 1927, and when I saw it, on March 22 last, had crushed about 2,000,000 tons from 10 in. to ⅝ in. in one pass, the only repair necessary being a new mantle to replace the original one that had worn thin and finally cracked. There was a little trouble with the lubrication at first, but this was soon remedied. Since I was there, an additional 1,500,000 tons has been crushed.

There is no way of measuring accurately the capacity of the machine, as undersize received from the mine is



screened out with a $\frac{5}{8}$-in. Chino impact screen before crushing. It is probable that it could handle about 500 tons per hour, though about 300 tons is the usual feed; at this reduced rate, a little less than 100 kw. of power is consumed. Among the early installations of the cone crusher were two at the Federal Lead concentrator and two at Anaconda, the Anaconda installation crushing about 1,000 tons an hour, but not so fine as the Chino machine. One's first impression at seeing a cone crusher is that it is too light for the work it is doing, but it certainly stands up, and the extent of its one-stage reduction, with large capacity, is one of its most interesting features.

The $\frac{5}{8}$-in. product is elevated by a 38-in. elevator to surge bins, from which the ore is passed over four Hummer screens with $\frac{1}{4}$x$\frac{3}{4}$-in. holes. The undersize goes to the fine-ore bins, and the oversize is further crushed in 72-in. Garfield rolls which operate in closed circuit with the screens.

Arrangement of Flotation Section

The fine-grinding and flotation section of the plant is divided into seven sections, each with a capacity of 1,850 tons a day. Primary grinding is accomplished after elevating the ore, by an open-circuit rod mill, using 3-in. rods, the product from which is split between two 7x10-ft. ball mills. These are of local design, equipped with Hall spiral trunnion discharge, and they have no grates. Two-inch balls are used. The discharge from each ball mill is pumped to an 8x15-ft. Dorr bowl classifier, the circulating load being about twice as large as the original feed at the time I was there, though steps were being taken to increase this ratio through the addition of a few more rake classifiers. Eight-inch Wilfley pumps are used for pumping both the rod- and ball-mill discharge, gravity flow not being generally practicable in this plant. The product from the rod mills contains from 55 to 60 per cent solids, and that from the ball mills, 70 to 75 per cent. Bowl overflow forms the flotation feed.

The flotation installation is now being remodeled and will ultimately consist of eight rows of rougher cells and four cleaner cells, all being of the matless type. Rougher tailing goes to waste and rougher concentrate is pumped to the cleaners, the tailing from the cleaner cells being returned to the head of the rougher machines. The flotation concentrate is thickened and filtered in a Dorrco filter of the Shimmin type, which was originally developed at this plant by J. T. Shimmin, formerly superintendent of mills at Hurley.

Lime Increases Selective Action

The flotation reagents include 0.06 lb. per ton of sodium xanthate, 0.24 lb. of Yarmor pine oil, and 6 lb. of lime. Lime is added in the form of milk-of-lime to the ball mills, xanthate is introduced into the bowl-classifier overflow, and the pine oil is added to the distributing boxes for the rougher cells. Formerly, only $2\frac{1}{2}$ lb. of lime per ton was used, but it was found that increasing the amount to 6 lb. had an excellent effect in dropping iron, which is in the form of pyrite.

At the time of my visit the mill feed was averaging about 1.3 per cent copper; the tailing, 0.18 per cent; and the concentrate 35 per cent copper, and 6 to 8 per cent was "insoluble." The principal loss is in the minus-200-mesh material.

A modern power plant was being installed when I was there, and is now in service. This comprises a 7,500-kw. Allis-Chalmers turbo-generator, displacing three old 1,750-kw. generators driven by reciprocating engines. On the rod mills I noticed that Westinghouse inclosed-clutch type synchronous motors were used. These, I understand, have been very satisfactory, and are there considered superior to having a separate magnetic clutch in the drive.

Pumping of the water supply for the mill is a problem here, as it is at Ajo, though not to the same extent. A good water supply is available about three and a half miles away from the mill, the wells being 130 ft. deep, with a water temperature of 94 deg. F. An air lift is used.

Labor Efficiency Greatly Improved

Simplification of the flow sheet has brought about reduction of the number of men engaged at Hurley from about 850 to 550. Merely because one has an old plant, it need not necessarily be filled with out-of-date equipment. This tendency to scrap the inefficient machine and flow sheet just as fast as a better one can be devised is evident in practically every plant that I visited and is one beneficent result of the recent struggle to bring costs sufficiently below a depressed selling price to make a reasonable profit.

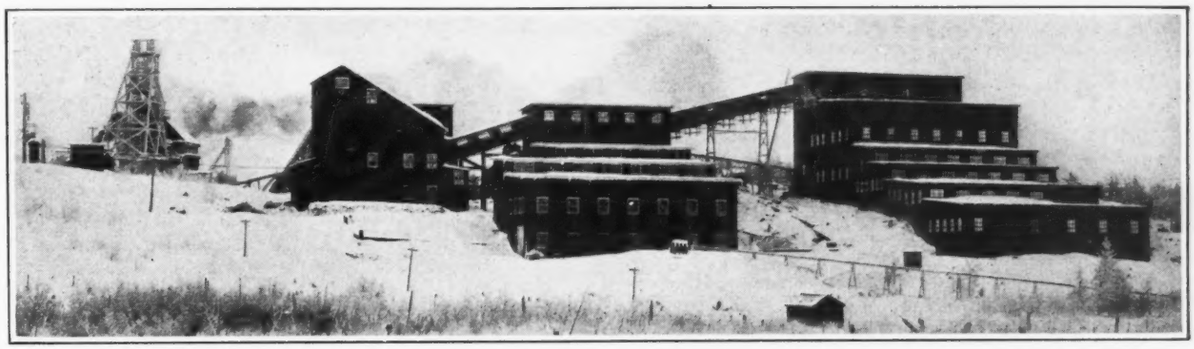
Returning to Deming from Hurley, I experienced a shower for five minutes, the first rain that I had seen for a month. It was said, though, that the late winter had been fairly moist in the desert, which should have brought out the poppies and all the other brilliant desert flora. Unfortunately, I was a little early to get the benefit of this display, April being the month in which the flowers appear at their best.

(To be concluded in an early issue, with a brief description of present operations at the El Paso smelter.)

When a Volcanic Explosion Forms a Pipe

ALTHOUGH the fact was established several years ago that the diamondiferous pipes of South Africa, from which diamonds worth over one billion dollars have been mined since their discovery, are "volcanic explosion pipes" or "maars," formed by an explosive puncturing of the earth's crust by magmatic gases, it is less generally known that geologic structures of the same type exist in many mining camps of the United States; and that from the orebodies which some of them contain has been extracted gold, silver, and copper worth nearly half a billion dollars. This subject has been receiving the attention of Mr. R. T. Walker, geologist on the staff of the U. S. Smelting, Refining & Mining Exploration Company, and the results of his researches and a statement of his conclusions and deductions are scheduled to appear in forthcoming issues.

A Pioneer Effort to Mine Low-Grade Ore in Ontario



Plant of the Porcupine Paymaster Mines, Ltd., South Porcupine, Ont. From left to right, No. 3 shaft, No. 2 shaft, crushing plant, cyanide mill, and the new concentrator.

The Porcupine Paymaster Project

CONCLUDING INSTALLMENT

By A. H. HUBBELL
Associate Editor

GEOLOGICAL FEATURES of the Porcupine Paymaster property and the mining practice hitherto pursued were discussed in Part I, which appeared in the issue of Nov. 10, 1928. In the following pages the metallurgical problem involved is touched on and interesting details regarding the weather-proof construction of the plant are given.

The Metallurgical Problem

In outlining the features of the Porcupine Paymaster project, it has already been said that the scheme provided for concentrating 1,500 tons of ore per day in a newly erected plant and then treating the 150 tons of concentrate thus produced in a 350-ton cyanide plant, to which crude ore also would be fed to bring it up to capacity.

Crushing equipment for both mills is shown in the flow sheet of the cyanide plant, reproduced in Fig. 1. From the shaft the ore is delivered by tramcar to the top of the 350-ton bin of the crushing plant. After being crushed to $\frac{3}{8}$-in. size, it is delivered by belt conveyor to a dividing box, whence it may be discharged either to the cyanide plant's 350-ton crushed-ore bin or that of the concentrator, holding 1,500 tons.

THE CONCENTRATOR—COARSE GRINDING SUFFICIENT

The question will naturally be asked by some: "Why not flotation instead of tables?" To this the answer has been given: (1) That the ore contains considerable visible gold, which it was not desired to grind fine enough to float; and (2) that tests showed such a remarkable saving (93 per cent) by tables on 40-mesh material that it seemed cheaper to grind to this coarse mesh and table the product than it would be to grind much finer and float the sulphides. Extensive tests of the ore, covering both water concentration and flotation, were made by the General Engineering Company. Since this article was written the concentrator has been shut down.

The scheme of concentration devised for the new plant was thus predicated on the theory that grinding to 40 mesh would liberate 93 per cent of the sulphides. Each of the three units is equipped with a 7x6-ft. ball mill, without grates, and in closed circuit with a classifier. According to the plan, the overflow was treated in a bowl classifier, the overflow of which was discarded, the sands going to the tables. Eight roughing tables and three finishing tables form a unit, the finishing tables running on the middling from the roughers, which was not reground, and making but two products, a concentrate and a tailing. The table concentrate was dewatered and sent by a belt conveyor to the cyanide plant. Dewatering of the table tailing was accomplished in an 8-ft. Dorr classifier, and the slime was thickened in a 40-ft. Dorr tray thickener. Tests and operation showed the slime to be so low in gold that it would not pay to give it further treatment.

I will not dwell on the difficulties that were encountered in the attempt to concentrate the ore. Only one who has been closely connected with the work should do this, and that later. In the end they may prove to

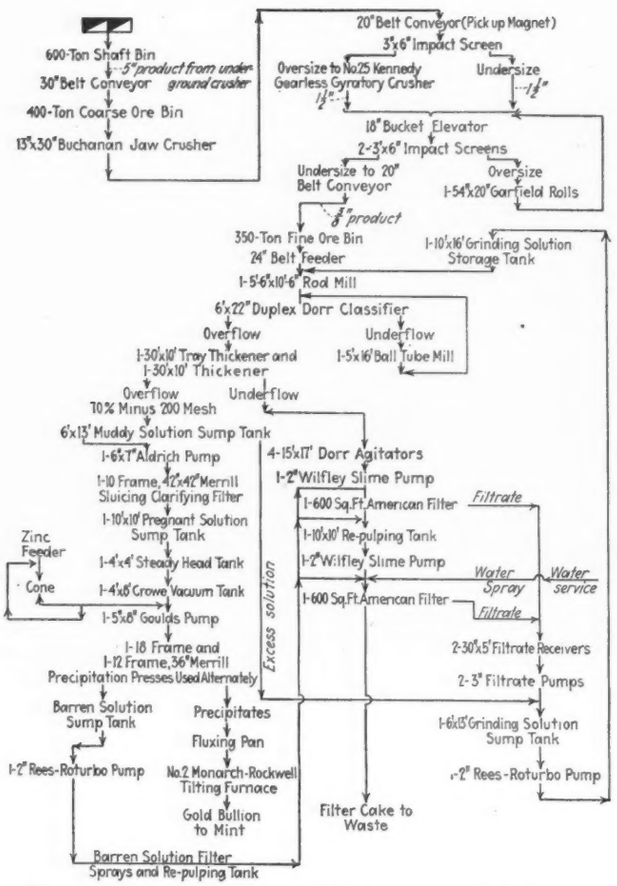


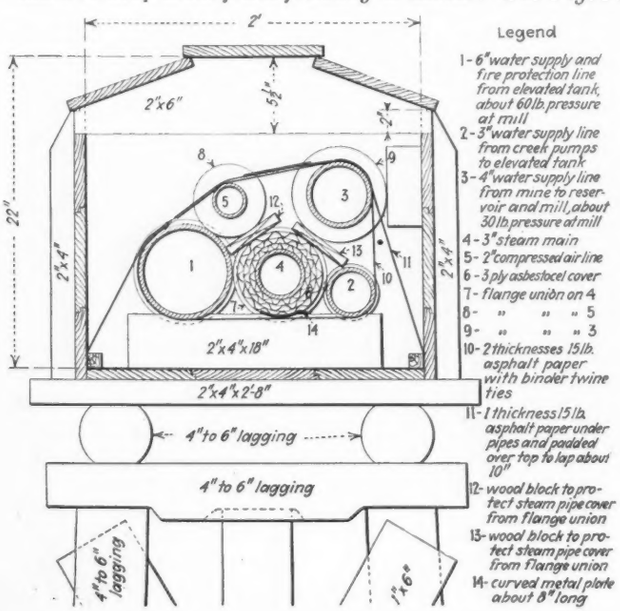
Fig. 1—Flow sheet of crushing and cyanide plants

be no worse than those that have arisen elsewhere on trying to make a new plant behave as laboratory tests have said it should. The Paymaster ore is peculiar in that it is almost free of colloidal slime. It was because of this, perhaps, and also possibly because the proper conditions for operating the ball mills had not as yet been worked out, that some trouble was experienced in preparing the pulp for tabling.

In its layout the concentrator is exceedingly neat and compact. Its design embodies four good features—arrangement in units; straight-line flow; good lighting; and grouping of equipment by classes. The concrete floors are provided with channels to facilitate their being washed.

The cyanide plant has virtually been a testing plant, in the opinion of the operators. It is unnecessary to repeat the details given in the flow sheet. With heads of $2.65, an average of 17c. combined loss had been obtained for three months at a time, I was informed. Of this the loss in solids had been about 12c. Average combined loss over a two-year period had been 20c. The strength of solution is 1 lb. of (Cassell brand) cyanide per ton, and the lime used 1 lb. per ton. Cyanide consumption has been 0.4 lb. per ton, figured to 100 per cent KCN. The amount of lead acetate added is 12 oz. per 100 tons of solution precipitated. Precipitation is effected in a separate locked building without attendance, pressure gages in the main mill showing the condition of the presses in the refinery. Both the pregnant and the barren solutions are sampled by drill samples taken in the main mill. The precipitate, running $75 per pound, is smelted direct without acid treatment. An interesting feature of the plant is that all pipes containing cyanide solution are painted red.

Fig. 2—Cross-sectional sketch of pipe box showing method of grouping water and air lines about steam main to keep them from freezing in winter. See Fig. 3.


2'
2"x6"
5½"
2"
22"
2"x4"
2"x4"x18"
2"x4"x2'-8"
4" to 6" lagging
4" to 6" lagging
4" to 6" lagging
1"x6"
Legend
1- 6" water supply and fire protection line from elevated tank, about 60 lb. pressure at mill
2- 3" water supply line from creek pumps to elevated tank
3- 4" water supply line from mine to reservoir and mill, about 30 lb. pressure at mill
4- 3" steam main
5- 2" compressed air line
6- 3 ply asbestocel cover
7- flange union on 4
8- " " " 5
9- " " " 3
10- 2 thicknesses 15 lb. asphalt paper with binder twine ties
11- 1 thickness 15 lb. asphalt paper under pipes and padded over top to lap about 10"
12- wood block to protect steam pipe cover from flange union
13- wood block to protect steam pipe cover from flange union
14- curved metal plate about 8" long

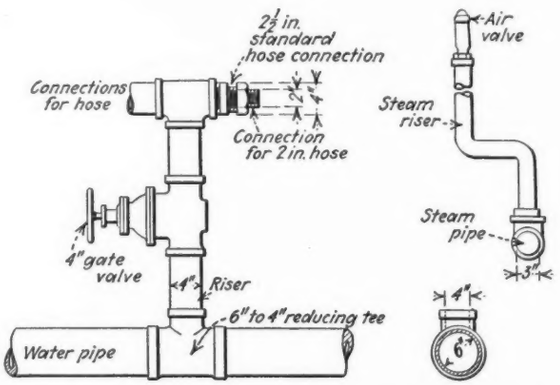


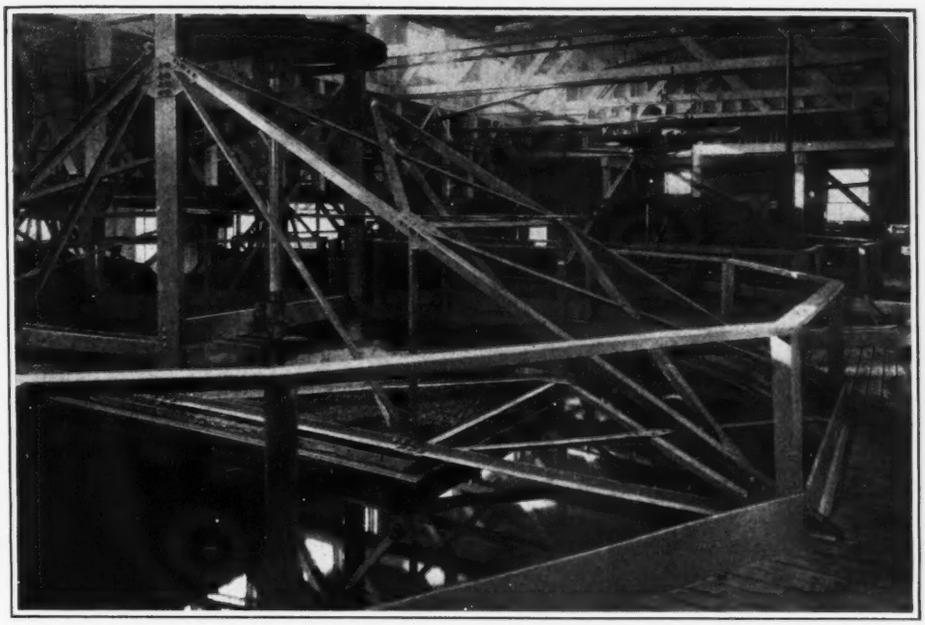
Fig. 3—Fire hydrant tapped into water main (1, shown in Fig. 2). Note connections for two sizes of fire hose. A steam riser tapped into steam main (4, in Fig. 2) serves to keep the hydrant from freezing.

Plant Well Built

Constructional details of the Paymaster plant offer much of interest. Effort has been made to conserve heat in winter, in order to reduce the condensation of moisture, thereby preventing the needless rusting of equipment; also to reduce vibration, and to protect against fire.

In the new concentrator, the side walls are constructed of 1-in. British Columbia cedar shiplap laid over the 2x8-in. studs. Over this is laid Celotex industrial board, then a layer of spruce building paper and, finally, mineral-surface asphalt siding. The last is laid on 18 in. in width, with a 2-in. lap, and cemented.

The roof of the concentrator is of the three-ply built-up standard type. It consists of two layers of 15-lb. asphalt felt and a mineral surface (crushed slate) cap sheet, cemented with about 80 lb. of asphalt to the square (100 sq.ft.). This is laid on Celotex industrial

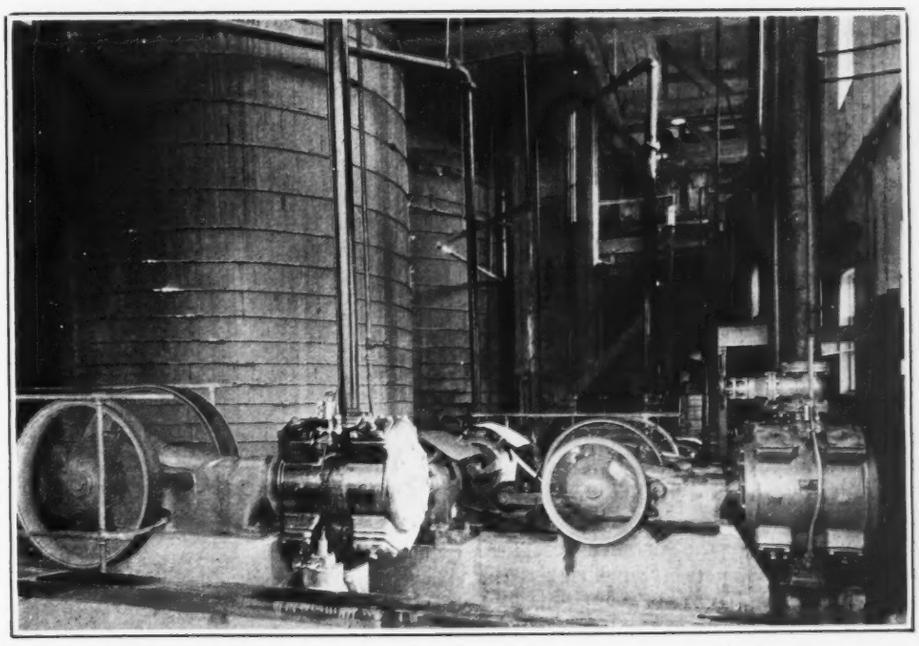


Thickener section of Porcupine Paymaster cyanide plant

board, beneath which is 2-in. tongued-and-grooved British Columbia fir, which is laid on the purlins, these resting directly on the trusses.

Comparative prices showed that steel window frames were cheaper per square foot of glass area than frames of wood. They were therefore adopted. The steel frames used have given no trouble from swelling or shrinking. A frame of 2x4-in. timber, caulked with oakum, is all that is required. Their use saves the cost of the ordinary sliding window frame.

Plants in cold climates, such as that of the Porcupine district, are usually inconvenienced by the condensation of moisture on the ceilings and walls in winter. At times these fairly drip water from this cause. Mr. Clement believed that this was really caused by the chilling, below the dewpoint, of a thin layer of air next to the walls and ceiling, so that it condensed its moisture. Aërofin-type unit heaters were installed in the cyanide plant, keeping the air from stagnating near the walls, and there has been practically no condensation on the walls and none on the ceilings. These heaters are operated by a $\frac{3}{4}$-hp. three-phase motor, and their fans are continuously run in winter to provide circulation of air. Unless the mill is shut down, no steam is circulated in the coils, although one heater is sometimes operated for a few hours at night in the coldest weather. In this plant the heat liberated in grinding plus that from the motors serves to keep the temperature of the solutions at about 70 deg. F. in the coldest part of the winter, and that of the air at 60-65 deg. F. The concentrator has not yet been operated in winter, but to make a closed heat-circuit of the water similar to that of the solutions in the cyanide plant, all products were dewatered, as has been explained, and the water was returned for further use. This greatly reduced the volume of incoming water required and also returned a great portion of the lime, a small amount of which was added to assist settling of the slime.



Solution and vacuum pump section of cyanide plant

Good lighting is provided in the mill by ample window space supplemented by painting the walls and ceiling white, save for the dado around the wall, which is painted grey.

Precautions against fire have been taken by the company. In addition to the 10,000-gal. water tank which, under 60 ft. head, constitutes the main water supply for the vicinity, and a 100,000-gal. reservoir of mine water for various uses in the mill, a gasoline booster pump having 250-g.p.m. capacity has been provided for use in case of fire. But even where water is plentiful, fire hydrants sometimes freeze, so into the housing of each outside hydrant a steam pipe—a riser with an air valve on the end—is introduced. This is shown in Fig. 3. The same illustration also shows the precaution taken with respect to the fire line connections on the hydrant. Each end of the duplex hose connection is equipped, as shown, with the 2-in. connection for the water lines used about the camp; also with the 2½-in. standard hose connection used by the fire departments of Timmins and South Porcupine, this in case of a fire calling for the service of these departments.

A detail of interesting practice, designed to keep the various water lines from freezing, is illustrated in Fig. 2. This shows the way in which the three water lines and the air line are grouped about a steam line in the pipe box in which they run over the surface between the various buildings about the camp. Building paper laid over the lines inside the box suffices to confine the heat.

Still another precaution not always adopted has been taken: both ends of the conveyor gallery running from the crushing plant to the cyanide mill are insulated against the spreading of fire by means of specially constructed doors. These doors are of wood, covered with galvanized iron with the edges crimped together. The partition around the door is similarly covered on the downward side.

Fire extinguishers of the soda-acid type for ordinary fires and Pyrene extinguishers for electrical or oil fires are distributed about the mills and other buildings of the plant. These are hung upon red boards to make them conspicuous.

All these precautions, together with the provision of a watchman's clock system of fifteen stations, have the net result of considerably reducing the cost of fire insurance on the plant.

What might be considered a further precaution against fire is to be found in the records of the supply house. For these the Brooks Visualizer system is used. This has the form of a book and can be placed in the safe when not in use.

Other Construction

The dormitory is of such construction that it can be said to be proof against vermin, sound, and fire, and is insulated against the cold with the aid of Insulex. This is a cellular product having about the insulating value of cork, and is made in the form of a powder consisting of gypsum and an ingredient acting as a "yeast." It is delivered in this powder form. When mixed with water, it foams and sets with innumerable small cells, the weight per cubic foot after setting and drying being 8 lb. for the lightest grade and 18 lb. for the next heavier grade. A still heavier grade of 30 lb. is also made. The 8-lb. grade was used in the instance described. In using this material in construction work it is mixed with warm water and poured into the wall immediately so that the rising action that ensues takes place in the wall. In building the dormitory the Insulex was poured in a snow storm at a temperature of 10 deg. below zero. A section 3 ft. in height may be poured at a time, with only a half hour's delay between pours. The interior walls of the dormitory are finished with Stiploid paint. Cottages similarly insulated have also been erected.

The Staff

Up to the time of my visit (in June, 1928) Mr. Clement's staff had included the following: Construction superintendent, E. E. Nelson; mill superintendent, Ronald Vary (the mine superintendent was Charles F. Jackson, who had joined the staff in April of this year); mine engineer, E. A. Filmer; chief electrician, E. A. Keats; assayer, N. J. Norton; accountant, C. R. Connors, and purchasing agent, C. E. Cook. W. W. Hudson was construction superintendent during the building of the cyanide mill and assisted in working out some of the mining details.

The International Temperature Scale

THE Seventh General Conference on Weights and Measures has adopted provisionally a temperature scale, including certain standard temperatures, interpolation formulæ, and methods of measurement. This scale will be used by the Bureau of Standards and other national laboratories.

In addition to the melting and boiling points of water (0 and 100 deg.), the standard temperatures adopted are:

		Degrees Centigrade
(*a*)	Boiling point of oxygen	182.97
(*b*)	Boiling point of sulphur	444.60
(*c*)	Melting point of silver	960.5
(*d*)	Melting point of gold	1063

The platinum resistance thermometer is standard below 660 deg. C.; the platinum-rhodium thermocouple between 660 deg. and 1,063 deg. Above 1,063 deg., the temperature scale is based on the Wien-Planck equation with c_2—1.432 cm. deg. There is also included a series of temperatures for calibrating secondary measuring instruments, and details of experimental technique.

The complete text of the decisions of the conference appeared in the October number of the Bureau of Standards *Journal of Research*.—George K. Burgess, in *Science*.

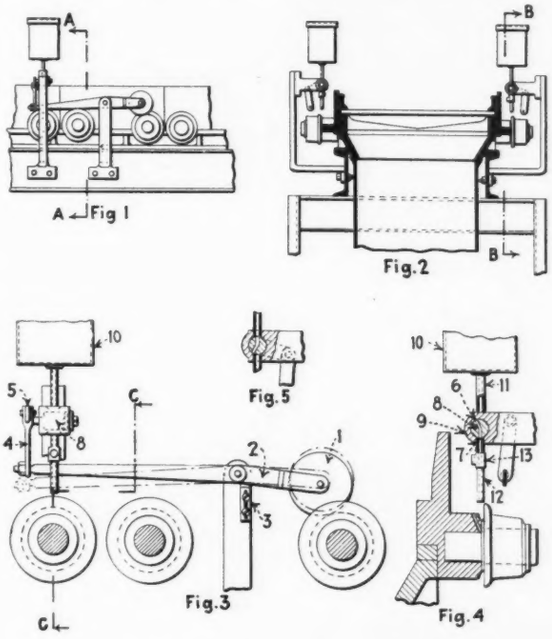
Mining Methods In the Lake Superior Region

ONE of the most helpful features of technical publicity is the wider dissemination of information on successful mining methods. At a recent meeting of the Lake Superior Mining Institute, Mr. R. B. Wortly, chief mining engineer for the M. A. Hanna Company, described a novel method of sublevel stoping in practice at the Carpenter and Monongahela mines, near Crystal Falls, Mich. The method involves the filling of the stoped-out area as soon as the ore has been removed, and the use of bulkheads to keep the sand, gravel and water from entering the mine. The account is scheduled to appear in a forthcoming issue.

USEFUL OPERATING IDEAS

Pallet Roller Oils Sintering Machine

AN AUTOMATIC device, applicable to many types of machines, for lubricating the pallet rollers of Dwight-Lloyd sintering machines has recently been developed at the Tooele smelter of the International Smelting Company.



Figs. 1 to 5. Details of oiler for pallet roller of sintering machine.

The general details of the device, supplied by Edward Cuddihy, the master mechanic, are shown in the accompanying sketches.

Fig. 1 is an incomplete side view of the sintering machine, showing the device in place. Fig. 2 is a cross section through the wind box along *AA* of Fig. 1. Fig. 3 is an enlarged detail section along *BB* of Fig. 2. Fig. 4 is a section along *CC* of Fig. 3, and Fig. 5 is a detail sketch of the alternate position of the valve shown in Fig. 4.

In operation, the pallets of the machine move slowly toward the right (in Fig. 1), and when they are in the position indicated by the full lines in Fig. 3, the weight of the roller 1 tends to keep the lever 2 against the stop 3 and through the link 4 and lever 5 maintains the openings 6 and 7 in the key 8 of the valve 9 in the relation shown in Fig. 4. This prevents the passage of oil from reservoir 10.

As the progress of the pallets continues from left to right, the next successive wheel comes in contact with the roller 1, and cams it up to the position indicated by the dot-and-dash lines of Fig. 3. This tilts the lever 2, and the link 4, and lever 5 turns the key 8 of the valve 9 to a position as shown in Fig. 5. This permits the momentary alignment of the opening 6 with the orifice in the nipple 11, and fills the key with lubricant.

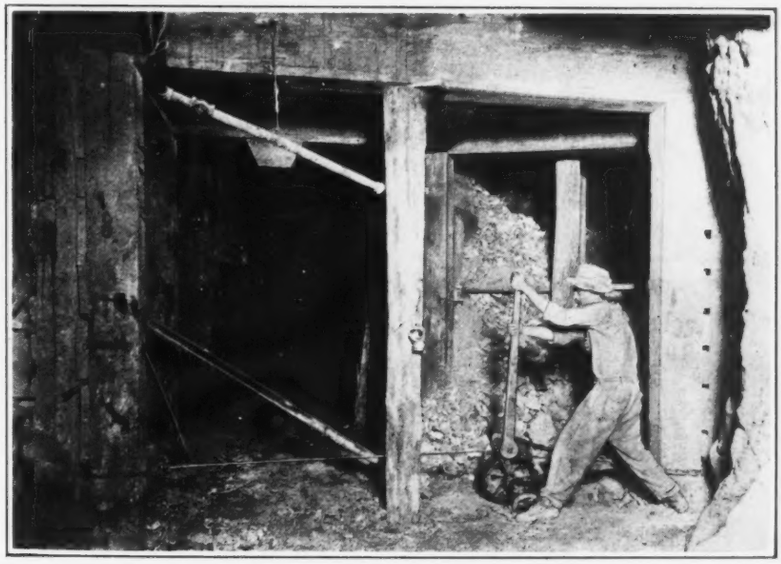
As the wheel moves on, the weight of the roller 1 causes the lever 2 to return to its original position against the stop 3. The valve key 8 also returns to the position shown in Fig. 4. The opening 7 now communicates with the pipe 12 and the oil contained in the key 8 runs down and lubricates the stub shaft. This operation continues as long as the machine runs and there is oil in the reservoir. The pipe tee 13 is provided in the lower pipe to form a vent and to avoid a tendency for capillary attraction to prevent the free flow of the oil from the valve. The valve can be slotted or cored to furnish a greater oil capacity if desired. Application has been made for a patent covering the device here described.

Stump Puller Used in Salvaging Underground Timber

OF THE material salvaged underground, at the Pilares mine of the Moctezuma Copper Company, the reclaiming of timber in good condition yields the greatest returns. The timber recovered consists of gangway timber lines of 10 x 10 in. x 8-ft. and 9-ft. posts, 10 x 10-in. caps, 6 x 6 in. x 6-ft cribbing, lagging, chute cribbing, chute lining, chute posts, split lagging, and, whenever there is an opportunity, timber from square-set stopes.

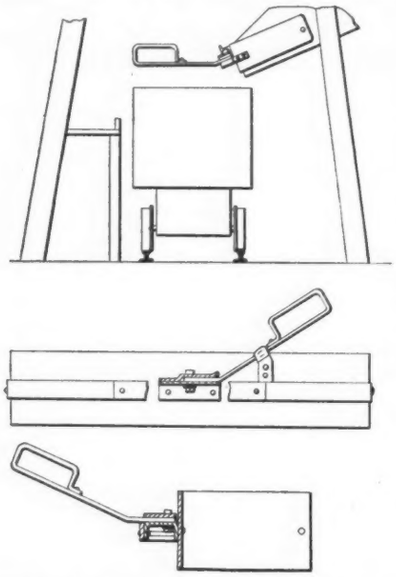
Posts are taken out by means of a stump puller with a crew of two men. One end of the puller is anchored in a safe location, from which it is operated. The other end contains a strong wire cable, which is attached by means of a hook and chain to the timber to be pulled out. No risk of injury is incurred in reclaiming timber. During the first six months of 1928 a total of 438,039 bd.ft. was recovered thus.

Reclaiming timber with a stump puller in the Pilares mine



Chute Gate Reduces Accidents

THE chute gate shown in the sketch, developed by John Williams, mine blacksmith foreman, has greatly assisted in reducing hand injuries in connection with tramming at the Old Dominion



The Williams chute gate, developed at Old Dominion mine

mine, according to Charles Mendelsohn, mechanical superintendent. A platform and foot shield for the operator are also shown. This shield under some conditions might prove more effective if placed at a high elevation.

Transfer Ladle Designed by Nevada Consolidated

A MATTE and slag transfer ladle of new design has recently been placed in operation by the Nevada Consolidated Copper Company on a standard-gage line between the reverberatories and converters at the company's smelter at McGill. The new ladle is an electric self-tipping type, and, with the exception of the motor, wheels, and axles, all the component parts were made at the company's shops. Special features in design include a three-segment construction of the ladle proper, the segments having horizontal joints. Details are shown in the accompanying illustrations.

Test for Amalgamable Gold

TO DETERMINE the amalgamable gold in an ore, an average representative sample, weighing a few pounds, is quartered, and a representative portion pulverized to pass a 40-mesh screen, according to John Watson, of Johannesburg, Transvaal, South Africa. Portions, preferably in duplicate, of, say, two assay tons are, assayed for total gold, by fire assay. A convenient weight of the pulverized ore, from 2 A.T. to 10 A.T., is taken, and the weight noted. Place the ore in 6- or 9-in. Wedgwood mortar, with sufficient water to form a thin pulp. Add a drop of redistilled mercury about the size of a green pea. Agitate the pulp in the mortar, using the Wedgwood pestle, for 10 to 20 min. Merely keep the mercury moving, so that it comes in contact with the ore; do not grind hard; attrition is to be avoided. If only 2 A.T. of ore has been taken, agitation for 10 min. should be sufficient; if, however, 10 A.T. is used, stir for not less than 20 min. When agitation is finished, pour off into a clean prospecting pan and add more water. The greater bulk of the mercury coheres together and can be easily recovered on washing. With refractory ore, especially if it contains arsenic or antimony, "flouring" of the mercury occurs. On washing and agitating in the pan, more of the mercury may be recovered, and this may be added to the bulk, which may be placed in the bottom of a test tube or annealing cup. For collecting the isolated beads of mercury, a small horn spoon is useful: failing that, a porcelain crucible may be used.

When the mercury is recovered it is washed with water and dried with filter paper; then poured into a thin-glass test tube (5 x ½ in. is a convenient size). Pure concentrated nitric acid, to a depth of about ¾ in., is now added, and the whole heated carefully. Dense brown fumes of nitrous oxide will be evolved at first; but the action should be continued until all mercury is dissolved and only residual gold left. Add more nitric acid if necessary. The excess of acid may now be poured off, and water added. The bead of gold is caught in an annealing cup, dried, and "brightened." The gold may be weighed as bullion; but, if fine gold is required, pure silver foil (or wire) is added, in the ratio of 2½ silver to 1 of gold. The bullion and silver, wrapped in a sufficient quantity of pure lead foil, is cupelled, and the residual bead may then be parted in nitric acid, (1:1), washed, decanted, dried, annealed, and weighed as fine gold. The first pair, done by fire assay, will show total gold and the percentage of free-milling ore will be obtained as described. For each assay ton taken in the trial, 1 mg. of gold found will be equal to 1 oz. Troy or 0.1 mg. will equal 0.1 oz. or 2.0 dwt. per short ton of ore. With the short ton (2,000 lb.) the weight of the assay ton is 29.166 gm., there being 29,166 Troy ounces in 2,000 lb. avoirdupois. The assay-ton system simplifies calculation of results.

The following results were obtained in actual practice:

Mine	Caught by Amalgamation, Per Cent	Remarks.
A. E., Transvaal	35.7	Refractory ore
The same, 3 days later	29.2	Refractory ore

Copper Queen Has Fine Employee-Service Record

THE Copper Queen Branch of the Phelps Dodge Corporation has the distinction of being one of the few remaining companies operating in the Southwest which employ American labor almost exclusively in actual mining operations, writes H. C. Henrie, manager of the Labor Department.

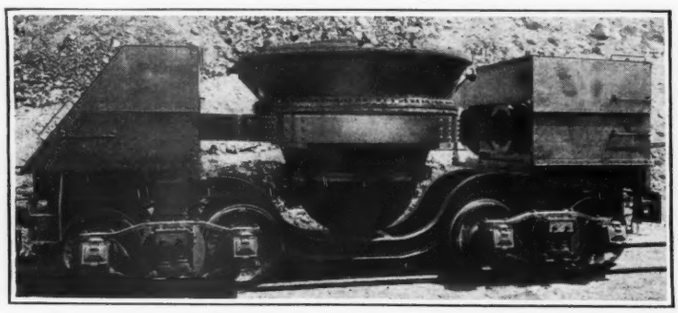
In the underground department, 97.5 per cent of the employees are either American citizens or else have signified their intentions of becoming such by making application for papers. Mexican labor is employed exclusively on surface roustabout work in connection with mining operations at Bisbee and in the smelting operations at the reduction works.

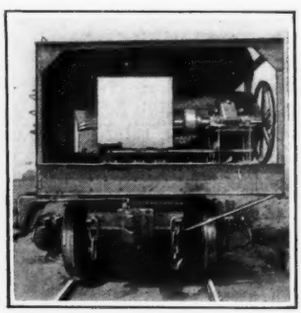
Married men comprise 71.3 per cent of the employees of the underground department and 65 per cent of all employees of the branch. The majority of the married employees own their own homes in the Warren district or at Douglas.

Many of the employees have served long with the Corporation, as indicated by the following tabulation:

Service Group	Number Employees
More than 25 years' service....	15
More than 20 years' service....	146
More than 15 years' service....	325
More than 10 years' service....	550
More than 5 years' service....	903

End view of new self-tipping ladle designed by Nevada Consolidated Copper Company. Center, side view of ladle. Right, end view, showing tipping mechanism.



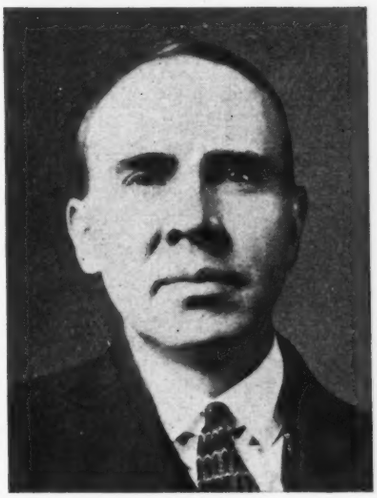


New Developments in Flotation Practice Discussed at Salt Lake Meeting

By H. D. Keiser
Assistant Editor

MUCH new information concerning the current trend of flotation practice was presented at the joint meeting of the Utah section of the A.I.M.E. and the northwestern Utah section of the American Chemical Society that was held in Salt Lake City on Nov. 8. More than a hundred members of the two sections were present, many of whom participated in a lively discussion that followed the presentation of the papers. The most significant fact developed in the meeting, and on which apparently a unanimity of opinion was expressed by the several speakers, was that a more definite control of the various phases of flotation is desirable, and that recent progress in this direction warrants a continuation of the research endeavor that has been responsible for the important results so far achieved.

In discussing the methods of measuring hydrogen-ion concentration, Dr. Thomas B. Brighton first explained that hydrogen-ion concentration, or the *pH*, of a solution is a measure of its activity, or of the intensity of its acidity. This intensity, he said, can be illustrated by noting the effect of certain one-normal acids on magnesium ribbon. For instance, hydrochloric acid reacts vigorously with the ribbon, acetic acid slowly, and boric acid not at all. Though these acids are all of the same concentration, there are fundamental differences in the way they behave, and these differences are attributable to differences in hydrogen-ion concentration. Older methods of measuring ionization by electrical conductivity, freezing point, or boiling point did not give concordant results, and have been replaced by methods that express the concentration in terms of its effectiveness or activity. These are practically all based on measurements made with the so-called hydrogen electrode.



DR. THOMAS B. BRIGHTON

How Hydrogen-Ion Concentration Is Measured

The tendency of a substance to go into solution decreases as its concentration in the solution increases. So hydrogen, which has a certain tendency to go into solution and to form hydrogen ions in pure water, has a less tendency to do this in an acid solution. The measurement of this tendency is a measure of the concentration of the hydrogen ions in the solution. Convention has accepted as a standard of measurement the tendency of gaseous hydrogen under a pressure of one atmosphere to form hydrogen ions in a solution. This tendency can be measured in volts, and the voltage of the two cells in circuit, one the standard, the other containing the solution under investigation, gives a measure of the hydrogen-ion concentration in the solution. Voltage is measured by means of a potentiometer. The standard cell mentioned is really hypothetical, as a cell containing a more dilute acid, or a so-called calomel electrode that has previously been checked against the hydrogen electrode, is actually used. With the calomel electrode there is a tendency to form mercurous ions in a potassium chloride or hydrochloric acid solution containing an excess of solid mercurous chloride.

A hydrogen electrode cannot always be employed conveniently, so in many cases the *pH* of a solution is determined by noting the color effect produced by the addition of certain indicators to the solution. Phenolphthalein is colorless with acids, and pink with bases, whereas methyl orange is red to acids and yellow to bases. A solution, however, may be at the same time acid to phenolphthalein and basic to methyl orange. These phenomena show that most indicators do not change color exactly at neutrality, but do change when the solution is actually on the acid or basic side of neutrality. On this fact depends the use of phenolphthalein when titrating weak acids, and the use of methyl orange when titrating weak bases. A study of some common indicators shows that:

Methyl violet changes from yellow to violet between 0 and 4 *pH*.

Methyl orange changes from red to yellow between 2 and 6 *pH*.

Litmus changes from red to blue between 6 and 10 *pH*.

Phenolphthalein changes from colorless to red at 9 *pH*.

In general it need only be remembered that *pH* 7 means neutral; a *pH* below this means acid, and one above alkaline. At the true neutral point, or at *pH* 7, litmus shows neutral, methyl orange basic, and phenolphthalein acid.

A variety of indicators have been selected for determining quickly the *pH* of a solution. These have been tested against the hydrogen electrode, and carefully standardized as to concentrations most desirable and as to color ranges. Each indicator changes color gradually through a certain *pH* range, so it is necessary in using them to select one that is effective in the *pH* range of the solution under investigation. For convenience certain manufacturers now supply color standards that show the colors produced by each *pH* within its color range when certain indicators are employed. It is possible for the investigator to prepare his own color standards, but this is rather difficult and time-consuming work.

In determining a *pH* value, ½ c.c. of indicator is usually added to 10 c.c. of the solution being examined, and the sample then compared with the standard colors. If the indicator selected is not in the proper acid range, another is tried with a fresh sample. This operation is repeated until accurate matching of colors is effected. The presence of a considerable amount of one or more salts, or organic matter, may affect results slightly, but this trouble is rare and can be compensated; it is not likely to occur in waters for mill use. Details of the procedure to be followed in making *pH* determinations are furnished with the testing sets that are now on the market.

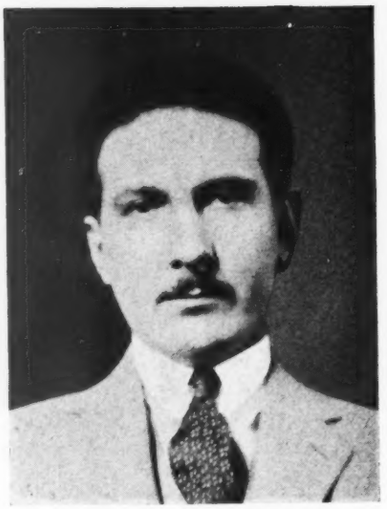
Application of Hydrogen-Ion Measurements to Selective Flotation

Prof. A. M. Gaudin, in his paper "The Influence of Hydrogen Ion Concentration on Recovery in Simple Flotation Systems," pointed out that the large increase in the use of selective flotation, as contrasted with the collective flotation of a few years ago, has focused attention on the desirability of achieving accurate control of the *pH* of mill circuits. Little is really understood, he said, concerning the action of the acidity or alkalinity of circuits, although it is well known that alkaline circuits result in dropping pyrite, and that acid

circuits conversely float it, but drop the gangue.

In general, a change in hydrogen ion concentration seems to affect either the mineral surface or the attachment of the collecting agent on the mineral surface. Owing to the overwhelming use of alkaline circuits employing specific chemical collectors, such as xanthates, thiocarbanilid, and dithiophosphates, the belief has arisen that these reagents cannot collect except in alkaline circuits. So far as the xanthates are concerned, this belief is entirely erroneous. Pyrite, in fact, is collected by xanthates far better in acid circuits; pure sphalerite is collected by them partially only and within a narrow *pH* range on the acid side of neutrality; whereas chalcocite is collected equally well at *pH* 1, 7, and 12. See Figs. 1, 2, and 3 on page 793. The striking drop in the curve of Fig. 2 in the *pH* range of 6.2 to 6.5 is all the more remarkable when it is observed that points *A* and *B* correspond to additions of 0.10 and 0.15 lb. of sodium hydroxide per ton of pyrite. Such additions of sodium hydroxide change the *pH* of the distilled water in use, from 6.2 to 10.2 and 10.5, respectively, in the absence of pyrite; to 6.4 and 6.7 in the presence of pyrite but in the absence of collector; and to 6.4 in the presence of both pyrite and collector. This indicates that OH ions are abstracted from solution by the pyrite, and that, coincidently with this phenomenon, there is a tremendous change in the floatability of pyrite. On the basis of the Debye-Hueckel theory of ionization, hydrogen and hydroxyl ions in water are hydrated; therefore, the abstraction of the OH ions by the pyrite might well result in lightly coating the pyrite with water molecules, and thereby wetting it, as well as preventing the xanthate from adhering upon the surfaces. It may therefore be concluded that Fig. 2 illustrates reaction of hydroxyl ions with a mineral surface.

The fact that xanthate is equally efficient in floating chalcocite in strongly acid or in strongly alkaline solutions suggests that within the range of *pH* 2 to 12, at least, there is little reaction between chalcocite and hydrogen or hydroxyl ions. Figs. 4 and 5, however, indicate strong dependance of recovery of chalcocite on the *pH* of the pulp when thiocarbanilid (diphenylthiourea) and iso-amyl amine are used. It will be noted that with iso-amyl amine an alkaline circuit is required, whereas thiocarbanilid calls for an acid circuit. Just why these reagents require particular hydrogen-ion concentrations is a matter of speculation. Possibly their coating the mineral surfaces may be achieved only by certain ions, or in the presence of certain ions derived from the collector and obtained only at a definite *pH*. It may be of interest to note that sphalerite is floated by iso-amyl amine under exactly the same conditions as chalcocite. (compare Figs. 5 and 6), although the reaction of these minerals when xanthate is the collector is altogether different. This circumstance adds strength to the belief that the *pH* restrictions imposed by iso-amyl amine are the result of reaction of hydrogen and hydroxyl ions with the reagent rather than with the mineral.



PROF. A. M. GAUDIN

From the selection of the foregoing examples, it might be thought that the *pH* of a flotation pulp has a considerable effect on sulphide minerals and collectors as applied to sulphides, but is unimportant in connection with oxide minerals, or non-metallic minerals. Such is not the fact, however; Fig. 7, for instance, indicates the marked effect of hydrogen-ion concentration on the recovery of malachite from a calcite-malachite mixture, using n-amyl xanthate without sulphidizing. Fig. 8 indicates that pure feldspar is floated by soap over a very narrow *pH* band, and even then the recovery is poor. Addition of copper sulphate results in a very marked activation of the feldspar (Fig. 9), which floats readily between *pH* 6.0 and 10.5. Quartz is activated by copper sulphate even better than feldspar (Fig. 10), the *pH* range being 6 to 11.0. On the basis of Figs. 9 and 10 quartz should be floated away from feldspar if the *pH* were properly controlled. This can be done to some extent, but the separation obtained is not entirely satisfactory.

In conclusion, Professor Gaudin said that considerable more experimental work would be necessary to reach a co-ordinated interpretation of the foregoing facts. A deduction, however, he added, might be expressed that apparently H and OH ions react with mineral surfaces in some instances, and that in others they are important factors in the adherence of collectors on mineral surfaces.

New problems encountered in the flotation of oxide ores were discussed by G. H. Wigton in his paper "Oxidized Ore Flotation at the Chief Consolidated Mill." Following a description of earlier unsatisfactory flotation practice employed at the Chief Consolidated property, he said that laboratory investigation had developed the following interesting facts:

1. Pulp produced from batch grinding in the laboratory ball mill yielded much better results than that produced by continuous grinding in the system comprising the Hardinge mill and Dorr classifier. Flotation in both cases was in the laboratory cell.

2. An attempt to float the slime present in the ball-mill feed before grinding produced a dirty, non-selective froth with little separation of mineral from gangue. However, after treating the very fine slime in the laboratory ball mill for the usual grinding time, good selection was obtained in the subsequent flotation.

It was concluded, therefore, that the grinding accomplished something, apart from reduction in size of particles, that was beneficial to flotation, and that the beneficial condition was produced to a greater extent in batch grinding than in continuous closed-circuit grinding.

As apparatus had just been received for testing hydrogen-ion concentration, a number of tests were made on water at the various stages of laboratory and mill operation. Such tests gave the following average results:

Fresh water from No. 1 shaft	7.8 to 8.4 *pH*
Pulp from laboratory ball mill	6.6 to 6.8 *pH*
Pulp in laboratory flotation	7.4 to 7.6 *pH*
Hardinge mill discharge	7.2 to 7.4 *pH*
Dorr classifier overflow	7.4 to 7.6 *pH*
Mill flotation pulp	7.4 to 7.6 *pH*

Inspection of the data shows that a higher *degree* of acidity was developed in the batch grinding of the laboratory than in the continuous closed-circuit grinding at the mill. This can be explained by the facts that the average time of treatment in the Hardinge mill was less than that in the batch laboratory mill, on account of the higher grinding efficiency of the continuous closed-circuit system at the mill, and that the particles were immersed in the alkaline fresh water used for classifier dilution once for every pass through the ball mill. Thus, even though the total amount of acid developed during grinding might be the same in both bath and continuous closed-circuit grinding, successive immersions in the alkaline water used for classifier dilution prevent the attainment of as high a degree of acidity in closed-circuit continuous grinding as can be attained in batch grinding.

The obvious solution of the problem, by the addition of sulphuric acid to the ball mill, produces flotation feed that yields results equally as good as those obtained on pulp produced by laboratory grinding. Control of hydrogen-ion concentration has explained the former difference between mill and laboratory operation. Further investigation of the flotation circuit showed that flotation pulp with less alkalinity yielded a cleaner concentrate but lower recovery than that with greater alkalinity.

After development of hydrogen-ion control in the grinding and flotation circuits, steady commercial operation of the mill was started on oxidized ores from various parts of the Tintic district. Ball-mill *pH* is held at 6.8 to 7.0, the primary flotation cells at 7.0, and the scavenger cells, where ethyl xanthate is added, at 7.2. Froth from the scav-

enger cells is returned to the primary cells for cleaning.

Metallurgical results of mill operation for September, 1928, follow:

Assays of Ore and Concentrate

Material	Tons	Au Oz. per Ton	Ag Oz. per Ton	Per Cent Pb	"Ins"	Cu	Zn	Fe	CaO	S
Ore	3,134	0.278	12.03	11.84	59.82	0.22	0.91	70.4	2.43	1.25
Concentrate	910.8	0.617	36.66	38.85	21.76	0.48	1.42	4.49	4.50	7.00

Recoveries obtained were: Gold, 64.33 per cent; silver, 88.56 per cent; and lead, 95.34 per cent. "Insoluble" elimination was 89.43 per cent, and the ratio of concentration was 3.44 into 1.

Mineralogical Association of Silver in Tintic Ores

"The Silver-Bearing Minerals of Some Tintic Ores" was the subject discussed by A. W. Hahn. He said that chemical and mineralogical determinations of siliceous oxidized lead-silver ores from the Tintic Standard and North Lily properties showed the silver to be present in the form of native silver, argento jarosite, argentite, and combined or inherent in tetrahedrite, chalcopyrite, galena, pyrite, cerussite, anglesite, mimetite, malachite, and iron oxide, and as silver occluded in the quartz. Careful microscopic work, he added, would probably show other forms in small amounts, such as the halide silver minerals and some of the antimony sulphide combinations.

Tabulation of the analyses of the various products shows no evidence of fixed ratios of silver to any particular base metal. The bulk of the silver associated with the sulphide minerals appears to predominate in the copper sulphides, more particularly the tetrahedrite. Most of the lead is present as cerussite and anglesite, and the ratios of lead to silver in the galena and oxidized lead samples, where the copper is less than 0.50 per cent, vary from 2.6 to 2.0 to 1. In the samples containing argento jarosite and a relative high percentage of iron oxide, the silver assay increases to a remarkable extent. Just what the particular red iron mineral is that carries this silver was not determined. Siderite is low in silver, as is a black variety that is high in lead. Pyrite in the samples carries little silver, and the varying percentages of iron in the sulphide products show no effect on the silver assay.

Data developed indicate the following general conclusions concerning the ores:

1. About one-half of the silver is present as a sulphide, or associated with sulphide minerals in a relatively small percentage by weight of the whole ore. This is true even of those ores that are highly siliceous, low in lead, and high in silver. This fact indicates that argento jarosite is not the predominating silver mineral.

2. Tetrahedrite carries extremely large amounts of silver.

3. The lead minerals, both sulphides and oxidized forms, show a low ratio of silver to lead.

4. The silver associated with a dark red siliceous iron oxide is widely distributed in these ores, and the percentage of this type of silver mineral is relatively high.

5. The amount of silver occluded in the quartz gangue probably does not exceed 2.0 oz.

Experience of the Utah Copper Company during the last four years in investigating the alkalinity at various

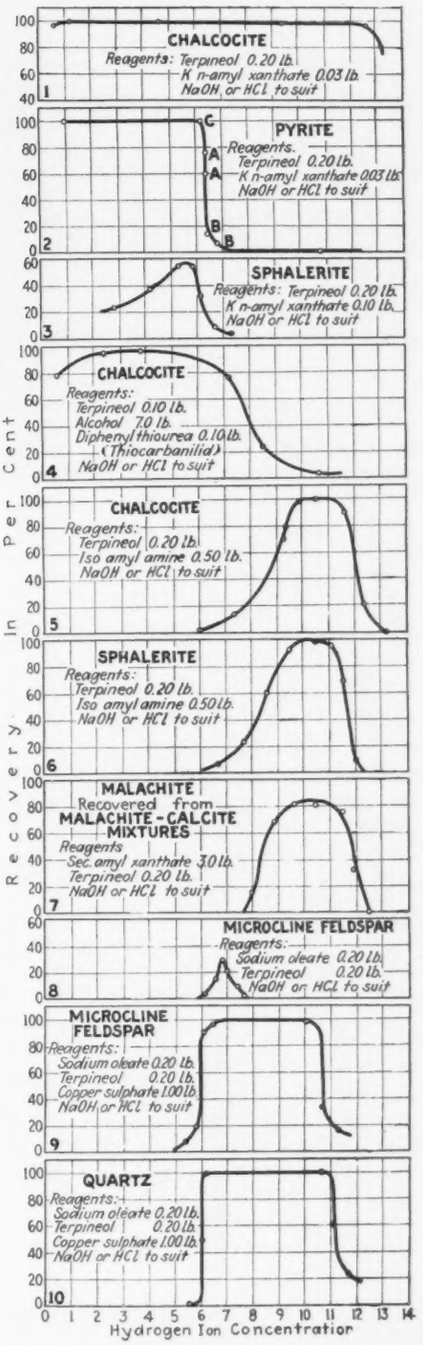
A. W. HAHN

points of the mill circuit employed at the Arthur plant was presented by H. S. Martin in his paper "Control of Alkalinity and Its Effect on Flotation." Accurate control of alkalinity, Mr. Martin said, was necessary to obtain satisfactory recovery of copper and rejection of iron during the milling of the company's ores that varied in content of these minerals over a considerable range. In this connection determination of the hydrogen-ion concentration of milling waters and pulps was essential.

In the course of the discussion that followed the presentation of the papers, to which reference was made in the foregoing paragraphs, G. H. Wigton explained that the low gold recovery obtained from the Chief ores was caused by the fact that a large portion of the gold occurred in the iron constituents of the ores, and that no attempt was made to float these constituents. In reply to an inquiry he also said that maintenance of *pH* control had added 20 per cent in recovery to the milling operations of the Chief Consolidated company.

A range of 0.4 was possible in *pH* determinations with commercial color comparison apparatus, owing to the personal factor involved, according to H. S. Martin, but A. M. Gaudin said that in using clear-water samples this range, in experiments conducted at the University of Utah, was appreciably less. Dr. Brighton added that it should be practical to make *pH* determinations by the potentiometer method, on which turbid samples would have no effect. Several present expressed the hope that the early future would see the development and application of continuous *pH* recorders that would also automatically control the addition of desired quantities of various reagents to the mill circuit as the hydrogen-ion concentration tended to alter. Such accurate control was apparently thought to be necessary in accomplishing further important advances in flotation practice.

Figs. 1 to 10—Curves showing relation of recovery to hydrogen-ion concentration



Personal Notes

JAMES S. DOUGLAS is at Cape Town, South Africa.

W. W. MEIN, of San Francisco, is on a visit to London.

STUART RAWLINGS has returned to San Francisco from New York.

WILLIAM C. BROWNING, of Los Angeles, has been in Utah and Colorado on professional work.

JOSEPH FINAGIN, mining engineer, has left Kennecott, Alaska, and is now on his way to Ray, Ariz.

H. DEC. RICHARDS, mining engineer, of San Francisco, is spending several weeks in New York City.

MARSHALL W. TUTHILL sailed for Europe from New York recently, and expects to be gone about one month.

PERCY BUTLER has returned to Joplin, Mo., after an examination of the Livingston mine, Custer County, Idaho.

CLIFFORD WILFLEY, mining engineer, of Denver, recently examined the Copper Bell property, near Silverton, Colo.

HARRY JENSEN, superintendent of Black Range Mining's flotation plant, near Santa Rita, N. M., visited Salt Lake City recently.

FRANK W. ROYER, mining engineer, of Los Angeles, is in New York on business. He may be reached at the Murray Hill Hotel.

JOSEPH A. INSLEE, of the firm of Easley and Inslee, mining engineers, sails from New York on Nov. 22 with his bride for Bolivia.

JOSEPH CLENDENIN, chairman of the board of Copper Exporters, Inc., returned to New York from abroad on the "Majestic" on Nov. 13.

ANDREW MILLAR has been appointed chief inspector of mines for the Province of Alberta, succeeding John T. Stirling, who resigned several months ago.

WILBUR H. GRANT, mining engineer, has returned to San Francisco after a professional trip to Mexico, where he had been for the last six months.

POMEROY C. MERRILL, of New York, is now associated with the Frank T. Day interests, operating in the Boise basin of Idaho. His headquarters are in Boise.

E. A. LORING, of Bewick, Moreing & Company, mining engineers, of London, will visit New York and various mining districts in Canada during the next month.

D. L. H. FORBES, general manager of Teck-Hughes Gold, is making an examination of the gold discovery recently made on the property of Capital Rouyn, in Duprat Township, Quebec.

F. J. KOHLHAAS, of Calumet, Mich., was elected vice-president of New Cornelia Copper, which is controlled by Calumet & Arizona, at a recent meeting of the board of directors of the company.

GEORGE H. GARREY, consulting geologist, of Philadelphia, who recently made a three weeks' examination of the May Day mine, in La Plata County, Colo., and also spent some time at Pitkin, Colo., has gone to Ely, Nev.

CHARLES F. JACKSON, until recently superintendent of the Paymaster mine, in the Porcupine district, has accepted an appointment on the technical staff of the U. S. Bureau of Mines in Washington. Mr. Jackson will be in immediate charge

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C. F. JACKSON

of the bureau's study of mining methods and their application to various types of ore deposits and the results obtained from these different methods. Mr. Jackson is secretary of the mining methods committee of the A.I.M.E. He is a native of Minneapolis. His education was obtained there in the public schools and at the University of Minnesota. He has worked in Montana, in Arizona, in Idaho, in the Sonora district of Mexico, in the Minnesota iron ranges, in Canada, and on the Isle of Cyprus. As a mining engineer in the service of the Standard Oil Company he did notable work in the application of mining methods to oil recovery.

LUCIEN EATON, superintendent in the Ishpeming district of the Cleveland-Cliffs Iron Company, has been appointed chairman of the metal-mining branch of the standardization division of the American Mining Congress.

F. A. LINFORTH, assistant chief geologist of Anaconda Copper Mining at Butte, spoke at a meeting of the Montana Society of Engineers on Nov. 12. His subject was "The Manufacture and Use of Engineering Models."

KIRBY THOMAS has returned to New York from California, where he made an examination of the German Bar mine, in Alleghany County, for the New Jersey stockholders of the company. THOMAS E. STEPHENS, of Auburn, Calif., is engineer and manager.

Dr. C. O. SWANSON, professor of geology at the Michigan College of Mining and Technology at Houghton, is in the Michigan iron district, collecting samples and studying iron formations in connection with research work in the concentration and beneficiation of low-grade ores.

Dr. KARL GLINTZ, of the faculty of the Technical High School of Berlin, Germany, recently visited the Michigan College of Mining and Technology at Houghton, investigating methods of ore dressing and mining. He also was interested in recent developments in flotation and iron-ore beneficiation.

A. W. FAHRENWALD, formerly of the U. S. Bureau of Mines and now professor of metallurgy at the University of Idaho, recently left the Michigan copper district for Moscow, Idaho, after a stay of about three weeks. He had been checking results of experiments in the application of flotation to the native copper ores of the Michigan district.

A. B. MARQUAND, formerly general manager of Sunnyside Mining & Milling, U. S. Smelting Refining & Mining subsidiary at Eureka, Colo., has been transferred to Real del Monte y Pachuca, at Pachuca, State of Hidalgo, Mexico, also a subsidiary of U. S. S. R. & M. Until recently Mr. Marquand had had his headquarters at the Salt Lake City office of the company.

Dr. L. DEWEZ, of Brussels, director of the Société Generale des Mineraux, the company which controls Belgium's lead and zinc smelters, and FRANCISCO E. SALAS, of Mazatlan, Sinaloa, Mexico, president of the Compañia Mexicana de Minerales, which is owned by the Belgian company, were recently in Denver to purchase mining machinery for the Mexican properties, at which a 100-ton lead smelter has just been blown in.

C. J. MARSH has been permanently appointed in charge of all metal purchases for the various divisions of the General Cable Corporation, with headquarters in the Graybar Building, New York. His chief interest will be in copper, lead, zinc, and tin. Mr. Marsh's knowledge of the metal trade is equaled by few; he has been, for many years, in charge of metal purchases for Standard Underground Cable, now a subsidiary of the new corporation.

F. W. BRADLEY, whose nomination for the presidency of the A.I.M.E. has been confirmed by the Board of Directors, was tendered a luncheon by the members of the San Francisco section on Nov. 5. Prof. E. A. Hersam, Frank L. Sizer, Frank H. Probert, and T. A. Rickard expressed the congratulations of the members and pledged their support to the recipient of the presidential honors for 1929. Mr. Bradley acknowledged the good wishes of his fellow members with a short address.

COMMENT AND CRITICISM

The Debasement of Silver Coinage

Producers Believe That Remedial Action Should Originate in the Countries Concerned

THE EDITOR:

Sir—The article "Silver Producers Missing a Chance," by Charles T. Hallinan, of London, England, that appeared in the Sept. 22 issue of *Engineering and Mining Journal,* reflects considerable study on the part of the author, and no exception is taken to the facts which he presents. Some of the conclusions that he draws, however, are debatable.

The subject discussed by Mr. Hallinan has been followed closely by the American Silver Producers' Association since 1914, when the Gold and Silver Committee of the United States Senate reported that the silver coinage of several European and American countries was being debased. Fourteen countries, owing either to their inability to obtain silver or to the excessive price of the metal, reduced the amount of silver in their subsidiary coinage during the war, some to the extent of 50 per cent. These facts were known by the association at the time, and, later, when the controversy concerning Indian coinage was a matter of serious discussion, the association had a representative in Europe to study the situation. In short, the association has given continuous study to the extent to which European silver coinage has been debased, and has been fully conversant with developments in this department of finance in the various countries of Europe as they have occurred.

European countries since the war have not shown any inclination to adopt their pre-war standards for silver coins; on the contrary, a trend in the opposite direction, as Mr. Hallinan points out, is noticeable. The situation provides ample cause for lament on the part of American silver producers, naturally, but to suggest that the association promote agitation among the peoples of the various European countries for "honest" silver coinage is ill-timed, no matter how desirous these peoples may be for a return to such coinage. Action of this nature should come from within each of these countries, not from without. The American Silver Producers' Association is committed to this policy. This commitment was not made until a report submitted by the association's special representative had been studied. This representative visited Europe for the express purpose of investigating this very phase of the silver problem.

The study revealed a significant unanimity among the important financiers, economists, and statesmen of Great Britain, all of whom were sympathetic and friendly to the views of the association on the general proposition of maintaining for silver a definite place in the money scheme of the world. The advice given was not to agitate the question politically, because such agitation would further complicate the matter and would delay the inevitable time when an international conference would be held to consider the whole silver question, and to consider especially standardizing subsidiary silver coinage for the purpose of relieving the increasing burden on a static gold production.

In the opinion of the officers of the American Silver Producers' Association, it would be unwise for private commercial interests to initiate a movement involving world-wide political and economic ramifications, as long as a reasonable hope exists that such a movement will in the not too distant future originate in the council chambers and banking rooms of Europe and America.

WILLIAM MONTAGUE FERRY,
President, American Silver Producers' Association.

Salt Lake City, Utah.

Against Suppressing Critical Opinion

THE EDITOR:

Sir—I am glad to see articles such as "Misconceptions of Canada's Pre-Cambrian Shield," by C. M. Campbell, published in your journal. I believe in analyses and "getting down to detail."

Here in the United States we have British engineers and geologists working side by side with American engineers, just as they are doing in Canada, South Africa, and other parts of the world. What is the difference? They are all working with the same objective. Because a man writes a technical article in Timbuctoo or Namaqualand about another territory, it does not follow that a deep study of the field in question has not been made. He is entitled to voice his opinion. We appreciate the different views expressed. Perhaps an article on "The Misconceptions of 'The Misconceptions of Canada's Pre-Cambrian Shield,'" would prove interesting.

JOHN SMEDDLE.

Fontana, Calif.

Building the Douglas Fountain at Nacozari

THE EDITOR:

Sir—Referring to the Douglas Memorial Fountain at Nacozari, Sonora, Mexico, which appears as the cover feature of your issue of Oct. 27, 1928, I have found among my old records for 1920 the following:

"A memorial in the form of a fountain has been presented to the people of Nacozari by the sons and daughters of Dr. James Douglas, and stands in the center of the small quadrangle opposite the entrance to the library.

"A circular basin 21 ft. in diameter is surrounded by an 8-ft. stone walk which is elevated about 3 ft. above the level of the park and is reached by three flights of stone steps. A group of three little girls in bronze, seated on a high rock from which the fountain gushes out, are looking down at three frogs, also in bronze, snuggled together on the curbing of a small basin set inside the larger basin, from which the water falls from the upper and smaller basin into the lower and larger pool.

"The plaza improvements include sidewalk curbing of rock, eight tall lamp posts of copper, made in the company foundry, and large stone vases placed in the center of the small grass and tree plots which will make up the two ends of the quadrangle.

"The bronze is after Max Blondat and the fountain is a copy of one in Dijon, France.

"The artist-architect in charge of the work is Leslie Cauldwell, of Paris, France, and he is assisted by a French stone cutter, M. Ratti."

As you will note from the context, Mr. Leslie Cauldwell, the artist-architect, brought with him from France a stone cutter, one M. Ratti. Monsieur Ratti was quite the idol of the camp during his stay at Nacozari, and a group of admirers was constantly on hand watching the progress of his handiwork, many of the details of which do not show in a photograph.

H. T. HAMILTON.

New York, N. Y.

[Our readers will recall that Mr. Hamilton was assistant general manager for the Moctezuma Copper Com-

pany during 1914-18. In the last-named year he was appointed manager of that important branch of Phelps Dodge operations until he returned to private professional work in 1921. His present association with the New York Trust Company brings mining engineering experience and executive ability to the banking industry.—EDITOR.]

The Enzlin-Eklund Process

THE EDITOR:

Sir—I was much interested in the article "The Enzlin-Eklund Platinum-Gold Amalgamation Process," appearing in Oct. 20 issue, on page 621. Could you advise if there is a representative for this process in the United States and, if so, the address? If there is any virtue in this process it will add greatly to gold production and assist the small mine owner in his efforts to conquer many difficulties that now confront him.

JOHN L. CAMPBELL.

San Bernardino, Calif.

[We regret inability to answer our correspondent's question in regard to United States representation. His letter is published, however, in the hope that the sponsors of the process in South Africa will communicate with him and with *Engineering and Mining Journal.* —EDITOR.]

The Gender of the Burro

THE EDITOR:

Sir—In your *Engineering and Mining Journal* last month I read a story about "The Vanishing Prospector." I'm not complaining about this story as a whole, but I do think you should be set straight about these here burros of mine, particularly in view of all you hear about woman suffrage and the general equality or even superiority of the so-called gentler sex.

In this editorial—I suppose you call it—I read where you said, "Even the burro . . . requires *his* customary ration. . . . Those who hold that *he* has had more success than the mining engineer, etc." In other words you credit "Jack" for the work that "Jennie" has done. Every prospector who has ever cinched a bellyband under a pack saddle should speak up in behalf of his compadre whose gender you betray. For every bonanza discovery in which a "Jack" brought up the beans and bacon there have been 100 where "Jennie" performed the heavy toting. Perhaps you are gonna ask, why this extraordinary superiority of the lady burro for packing? The psychological reason —I suppose you call it—may not be apparent, but it's the truth that "Jennie" has got a better disposition, is less likely to stray from her picket at night, and more able as well as willing to stand for an extra box of powder, or round of steel, to an overloaded pack saddle. What, you may ask, does all this have to do with finding mines? Simply this: how can anyone devote his best interests to the work at hand when he has to take a couple of hours off each morning rounding up "Jack" before he strays over the hill and spend a week or two doctoring up a cracked shin acquired in trying to slip on a couple of extra sides of bacon to an already overflowing pack when he thought the blamed critter wasn't looking? Or suppose he was blazing away to get that adit under the iron-stained croppings into the hill before snow and about halfway through discovers that he's out of powder just because that blankety-blank animal wouldn't stand for that extra half a box over in Beatty! What's the answer? I suppose you'll tell me to get more burros, and I say yes, but make sure they ain't no "Jacks" amongst 'em.

ALKALI LUKE.

Somewhere in the Panamints.

Fine Versus Coarse Grinding

Definite Relationship Usually Traceable Between Degree of Comminution and Resultant Extraction

THE EDITOR:

Sir—In reply to John Herman's discussion in your issue of July 14, 1928, I would like to supply him with extra data on which to base his calculations. The manner in which Mr. Herman has handled the subject is highly commendable, but his incorrect assumption made his conclusions very misleading.

Not digressing from the original point of discussion, Mr. Herman, in his article of Feb. 18, 1928, is supporting the fact that the object in grinding should be the production of a larger amount of intermediate size material and less of the excessively fine slime. The discussion centres about his statement, "There are few, *if any,* instances in metallurgy where it is desirable that all the material should pass through 200 mesh." He states that the Mount Lyell ore will serve as well as any other to prove his case.

Consider the data of the two tests under review, and shown in Table I. Both tests have feed similar in all respects.

Microscopic examination of tailing obtained from the treatment of North Lyell ore shows that almost all the copper content exists in the form of middling grains consisting of quartz and chalcopyrite or quartz and bornite. Even the minus-200-mesh material, assaying approximately 0.25 per cent copper, has much of the copper present in the unfreed state, and experiments have proved that between 45 to 55 per cent of this copper can be floated if this product is slimed to a greater degree.

The tests cited substantiate the conclusions derived from examination of the tailing under the microscope. It will be seen that although the tailing assays for the respective meshes are practically the same for all meshes above 200, the minus-200-mesh value of test No. 1 is 50 per cent greater than that of test No. 6. Since the finer grinding in the laboratory was obtained by a longer period of grinding, it is only right to assume that the minus-200-mesh material of test No. 6 contains a greater percentage, say, of minus-300-mesh material than that of test No. 1. The effect of this difference in the minus-200-mesh material is reflected in the tailing assay. Admittedly the feed assay of the minus-200-mesh material is much lower in No. 6 than in No. 1, but this also holds in the plus-120 and 200-mesh materials of both tests, and yet their tailing assays for the same mesh materials are practically identical.

Reviewing the figures discloses the fact that had the plus-80-mesh material alone in test No. 1 been reground (presumably to pass an 80-mesh screen) the recovery effected by thus

Table I

	No. 1 Test								No. 6 Test							
	Feed, Per Cent			Concentrate, Per Cent		Tailing, Per Cent			Feed, Per Cent			Concentrate, Per Cent		Tailing, Per Cent		
Mesh (I.M.M)	Weight	Assay	Distribution	Copper	Recovery	Copper	Loss	Original Value	Weight	Assay	Distribution	Copper	Recovery	Copper	Loss	Original Value
Minus 30 Plus 50	11.2	1.15	3.80	3.6	16	1.05	84	3.25	0.5	0.80	....	....	....	0.80	100	0.15
Minus 50 Plus 80	17.7	1.40	7.35	4.8	56	0.74	44	3.25	2.9	1.00	1.02	4.4	48.5	0.56	41.5	0.45
Minus 80 Plus 120	10.6	2.35	7.40	7.3	86	0.45	14	1.05	6.1	1.80	3.20	6.0	82.5	0.42	17.5	0.60
Minus 120 Plus 200	8.2	3.30	8.00	10.75	93	0.31	7	0.60	9.5	1.95	5.40	8.0	90.0	0.29	10.0	0.55
Minus 200	52.3	4.75	73.45	17.3	96.5	0.23	3.5	2.68	81.0	3.85	90.38	13.5	97.5	0.14	2.5	2.33
	100.0	3.38			89.2			10.83	100.0	3.43			96.0			4.08

Table III

	Screening Method	All-Sliming Method
Per cent of minus -200 material	50	99
Per cent loss by flotation	8	3
Cost of screening through 80 mesh	X cents	Nil
Cost of classifiying, per ton	Nil	(X-n) cents
Cost of grinding, per ton	(b) 33c.	66c.
Loss in tailing (a)	128c.	48c.
Total loss, excluding screening and classification	141c.	114c.

treating 28.9 per cent of the ore would be as effective as grinding the whole of the ore to that extra degree of fineness. In the laboratory, all the ore is subjected to extra grinding, but in plant work such a procedure would always be preceded by classification.

The minus-80-mesh product would have the screen analysis and metal distribution shown in Table II.

Table II

Mesh (I.M.M.)	Per Cent Weight	Copper Distribution
On 120	14.9	8.35
On 200	11.5	9.00
Through 200	73.6	82.65
Total	100.0	100.00

Now, the reground 28.9 per cent is assumed to have the same screen analysis as the material originally passing through the screen; also the same copper distribution.

Such a product would have an approximate recovery of 95 per cent, and since the amount of copper it contains is 6.5 per cent of the original, the per cent of original copper recovered would be 6.2. The total loss would now be 4.23 per cent. Compare the two examples.

However, the foregoing examples are not representative of the two methods in plant operation, for even the screened material contained 73.6 per cent of the minus-200-mesh material, and Mr. Herman wishes to obtain as little of this slime as possible and as much of the "finer intermediate sizes most desirable to produce." Thus, say that by maintaining a large circulating load on a ball mill, operating in closed circuit with a screen, a product be obtained in which there is a minimum of minus-200-mesh material.

Consider that a screen undersize product was obtained having 50 per cent of minus-200-mesh material and the mean average particle was plus-200-mesh. Compare with this product a finely ground slime obtained by the ball mill-classifier combination. Results are tabulated in Table III.

Mr. Herman's remarks concerning mineral content in plus-50-mesh material and 120 mesh and so on seem to me to be wide of the mark.

There is a definite relationship which almost always exists between the percentage recovery and the degree of crushing; another relationship exists between the degree and cost of crushing. Thus, if the percentage loss be converted into money value, the economic point can be determined when any further grinding would not be compensated by the decreased value of the tailing, or the saving effected by reversion to coarser grinding would be more than offset by the increased value of the tailing. At Mount Lyell, varying the degree of grinding from a trace on 48 mesh (Tyler) to a trace on 150 mesh (Tyler) effects a saving of approximately 24c. per ton.

M. PLAYFORD.

Queenstown, Tasmania.

(a) A 1 per cent recovery is worth approximately 16c.

(b) In the Table III the cost of grinding for the all-sliming method was derived from operating costs, in which case the ore was ground from minus-½-mesh to minus-200-mesh. The allocation of cost for the screening method is certainly a low figure, tending to favor this method.

Consultation

Preserving Timber With Zinc Chloride Applied Under Pressure

For years we have used a dipping process for treating timber. The results, however, are not uniformly satisfactory and we desire to substitute a pressure treatment process using zinc chloride, such as that described in the articles entitled "Why Let Mine Timber Decay" (abstracted from Bulletin 33, U. S. Bureau of Mines and Carnegie Institute of Technology), which appeared in the "E. & M. J." of April 14 and 21, 1928. Specifically please tell us the following:

1. For this pressure treatment we desire to use as the cylinder a discarded boiler designed for a working pressure of 100 lb. per square inch. Would this be strong enough?

2. What apparatus is necessary for obtaining the vacuum and applying pressure, or is this done with steam and compressed air? Steam is available on the spot at 125 lb. per square inch and compressed air at 80 lb.

3. Is the 50-per cent solution of zinc chloride applied pure or diluted and is it likely to corrode the cylinder?

At the editor's request, Harry E. Tufft, formerly with the Bureau of Mines and now with the Grasselli Chemical Company, Cleveland, Ohio, answers the foregoing questions as follows:

1. A pressure of 100 lb. per square inch is about the minimum used by pressure treating plants. The specifications of the American Wood Preservers' Association are commonly followed by these plants. Ordinarily, pressure plants using zinc chloride are operated at 125 to 175 lb. per square inch.

2. Vacuum and pressure are usually obtained by an air compressor and vacuum pump, although in some small treating plants at German mines a steam ejector has been used for producing vacuum. This method is described in detail in the 1927 proceedings of the American Wood Preservers' Association, page 131.

3. Zinc chloride in 50-per cent solution is reduced before use to 2 to 5 per cent solution, depending upon the type of wood to be treated and absorption desired. Solutions between the range of 5 and 50 per cent should be avoided.

The average cost of zinc chloride per cubic foot of timber treated is 4 to 8c. and the total cost of treatment is 10 to 20c. per cubic foot, at various metal mines and coal mines in the United States.

Standard practice in treatment of railway ties and other surface timber with zinc chloride is to specify a minimum retention of 0.5 lb. per cubic foot of wood. Though a 0.5 lb. treatment is common practice, we believe that a greater retention will give better results, especially in the treatment of mine timbers. It is desirable in treating mine timbers and ties to use approximately 1 lb. of zinc chloride per cubic foot, with a minimum retention of not less than 0.75 lb. Mine timbers treated with 1 lb. of zinc chloride have marked fire resistance, whereas the decrease in inflammability with 0.5 lb. treatment is not so marked. The higher treatment should also increase the life of timber several years over that of timber treated with 0.5 lb. zinc chloride.

Zinc chloride is a low-cost preservative, and the use of 1 lb. increases the cost only slightly over that of 0.5 lb. The increase in fire resistance as the zinc chloride content is increased has been demonstrated in tests by the U. S. Forest Products Laboratory. An interesting test indicating that the higher treatment gives additional protection from decay under conditions of maximum severity is being conducted by the Santa Fe Railway. A group of fence posts, treated with over 1 lb. of zinc chloride per cubic foot and installed in 1913, are all perfectly sound in 1928 after fifteen years' service, whereas posts treated with slightly less than 0.5 lb. per cubic foot are showing signs of softening at the ground line after over fourteen years' service, and the untreated posts were badly rotted in three years.

Zinc chloride is shipped in solid fused form, in metal drums holding approximately 1,130 lb. net; also in granulated form in drums containing about 525 lb., 100 lb., and 50 lb. net. For wood preserving, the fused salt is commonly used, because it is cheaper and more convenient. Although zinc chloride is also supplied in 50 and 70 per cent solution, the freight on shipments to Spain (where the inquirer is located) would probably preclude its use, although cheaper than fused f.o.b. treating plants.

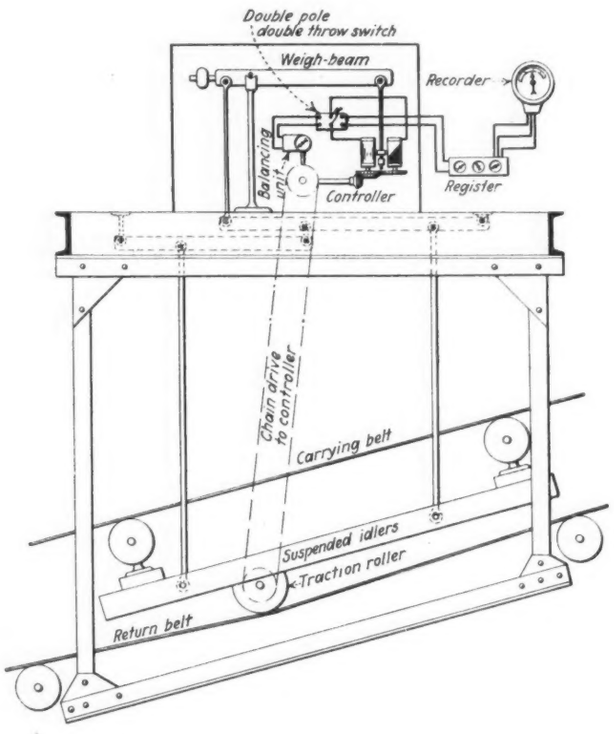
Bulletin 235 of the U. S. Bureau of Mines, on mine-timber treatment, gives details of methods of treatment. A description of a small-pressure treatment plant, used by the Miami Copper Company, is given in Bulletin 233 of the Carnegie Institute of Technology, Pittsburgh. The latter is also on mine-timber treatment and costs $2.

INDUSTRIAL PROGRESS

The Equipment Review

A NEW MACHINE for weighing materials in transit on conveyors is shown in the accompanying illustration. It is known as the Telepoise, and is manufactured by John Chatillon & Sons, 85 Cliff St., New York, N. Y. For use with belt conveyors, this machine is provided with a rigid stationary steel frame of sufficient length and width to include two carrying idlers and high enough to clear the load on the belt. This frame is less than 6 ft. long and takes the place of a corresponding length of conveyor stringers. Inside the stationary frame is another frame that is suspended from scale levers upon which are mounted the two carrying idlers. The check rods controlling the position of the suspended frame are attached to the stationary frame and are adjusted at the factory. Scale levers transmit the weight of the upper belt and its load to the weigh-beam as shown. The counterbalancing means controlling the position of the weigh-beam is a pair of Chatillon calibrated helical springs, not shown in the illustration. The amount of travel of the belt is transmitted to the controller by means of a sprocket and chain, driven by a traction roller riding on top of the return belt.

A totalizing register is placed at any desired distance from the scale and is connected to the controller by suitable wiring. The register is actuated by a simple form of step-by-step escapement movement, equivalent to that used in stock tickers, fire alarms, printing telegraphs, and similar operations.



A machine for weighing material in transit on conveyors

The controller is a pair of vertical drums revolving toward each other and driven by the chain and gears from the traction roller on the return belt. A corrugated surface on the left drum gives a vibrating movement to a contactor between the two drums. Half of the surface of the second drum is electrically conductive and half is insulated. The dividing line between the conductive and insulating surfaces is a part of a helix, so that the surfaces are like two equal right-angle triangles wrapped around a cylinder and fitted to each other.

Between the two drums the contactor is connected to the weigh-beam and moves freely and in unison with it. The corrugated drum is adapted to make and break the circuit several times a second at periods modified only by vibrations of the speed of the belt. The surface of the right, or contact, drum is such that when there is no load on the belt, no impulses reach the register. At maximum load, all the impulses are effective and the register advances continuously. Under intermediate loads the number of impulses that reach the register is exactly proportional to the load carried on the belt, and the register advances continuously.

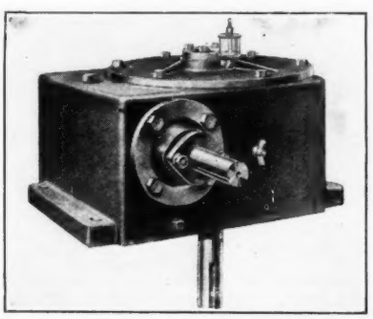
To record the weight carried on the conveyor, the register is equipped with contacts adapted to control a time recorder of familiar type with revolving paper charts, operated by the usual clock. This shows the amount carried during any period and also the duration of any interruptions in the operation of the machine.

The balancing of the Telepoise is accomplished by the use of a test weight, hung on the weigh-beam, and is representative of the normal load. A revolving dial moves continuously in proportion to the travel of the belt and a pointer moves with the dial in the same direction. When the balance is correct, the pointer follows the same figure on the dial; if not, the balance ball is moved as indicated and accuracy is assured without any other adjustment. The calibration at the factory is final and permanent.

Power Transmission Attracts Inventors

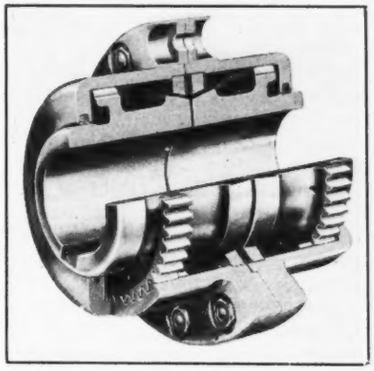
Several new devices for transmitting power have recently made their appearance on the market. Among these is a heavy-duty worm-gear speed reducer intended for vertical driving with the drive shaft projected at either top or bottom. This has been introduced by the D. O. James Manufacturing Company, 1120 West Monroe St., Chicago. The housing is of high-grade gray iron, and is provided with a large oil-cooking and heat-radiating chamber. Both sides of the gear shaft are sup-

This speed reducer is intended for vertical driving



ported by tapered roller bearings. The worm shaft is mounted on double Timken bearings on one side and on Norma Hoffman roller bearings on the other. This arrangement of the bearings insures the absorption of radial and end-thrust loads and does away with excessive heating and wear. The gear shafts are of 0.40 carbon steel, ground to size and made oversize to withstand emergency strains. The worms are integral with the worm shafts, which are of chrome-nickel steel. All gears are of high-grade phosphor bronze. This reducer is intended particularly for mixers, agitators, disk feeders, and other equipment that rotates on a vertical axis.

The same company has introduced a so-called combination automatic backstop and flexible coupling, designed for use on elevators, conveyors, and other drives where there is a likelihood of reversal of travel when equipment is standing idle or when the motor has



A flexible coupling of the all-metal gear type

been shut off after a day's run or in the event of motor failure. The unit consists of a drum-shaped housing, on the back of which is integrally made one-half of a flexible coupling which contains freely flexing, live rubber bumpers, and in which are cemented Bound Brook oilless bushings. A half coupling, fitted with hardened ground steel pins, which float inside of graphite-impregnated bronze bushings; a ratchet plate, three pawls with studs, springs and fastening bolts, and a two-piece cover plate complete the unit. This device has no friction surfaces or wearing parts. It is applied on the drive shaft between a speed reducer and the motor.

Still another flexible coupling is shown in the accompanying illustration. This is made by the Poole Engineering & Machine Company, of Baltimore. It is of an all-metal gear type and is lubricated and self-aligning without binding action at any point. The design is simple, there being no springs, bushings, pins, laminations, or other wearing parts. The gear teeth have spherically formed crowns on each hub and support the floating sleeve and allow free rocking action to compensate for any misalignment of the shaft.

A means of decreasing belt slippage on sleeves is provided in a material called "Pulleystone," according to the Chicago Belting Company, the manufacturer (113 North Green St., Chicago). It is intended for application to the surface of iron, steel or wood pulleys and is applied in a thin coat.

A New Battery Locomotive for Tramming Service

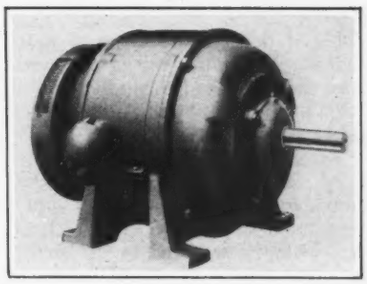
A battery locomotive designed for tramming service in metal mines has recently been introduced by the Atlas Car & Manufacturing Company, Cleveland. It is designated as Type "J." Because of its compact design and moderate weight (3,000 lb.), it can be run on any 48-in. mine cage and moved from level to level. It can be had for any track gage usually encountered and is so narrow that it can pass through the average timbered drift. The battery box can be quickly removed and replaced with a freshly charged battery. A spur-gear drive is used, the gears being completely closed and operating on ball bearings in an oil bath. A single high-efficiency motor geared to both axles is used. All parts are readily accessible.

This Mechanism Operates Valves

A new motor-driven device for operating valves is shown in the accompanying illustration. It makes possible the automatic operation of all valves up to 6 in. in size. The maker is the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Although this unit is so small that it can be held in one hand, it has a rating of 15 lb.-ft. It can be operated automatically by means of float switches, temperature-controlling devices, pressure regulators or by conveniently located push buttons. It is similar in principle to the company's standard Dean operating unit, which has been in service for about twelve years. Although designed primarily for service in industries where regulation of pressures and temperatures of gases and fluids is necessary, it is likewise adaptable to many other applications, such as operating skylights, radiators, and doors.

Motor Protected Against Dirt and Moisture

The motor shown in the accompanying cut is fully inclosed and fan-cooled. It is made by the Reliance Electric & Engineering Company, 1042 Ivanhoe Road, Cleveland, Ohio, being designated as Type AA. It is of skeleton-frame construction and uses an exhaust type



A protected motor that has some new features

fan, which is mounted on an extension of the shaft, outside the front bearing bracket. The external cooling air is drawn in through openings at the center of the bracket bearings, passing over the radiator bonnets and stator and being exhausted at the front end.

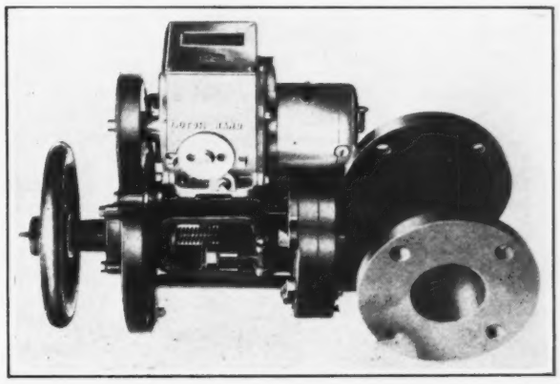
A New Solder for Railway and Mine Motors

Recently an alloy has been developed which is useful as a solder under severe conditions. It consists of lead as a base metal with additions of silver and copper, and starts to melt at 302 deg. C. It can be used in soldering with non-corrosive fluxes ordinarily used in soldering electrical apparatus and can be worked with a common soldering iron, which, of course, has to be heated to a higher temperature than when soldering with the ordinary lead-tin solders. It has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Supervisory Equipment for Automatic Switches

A synchronous selector type of supervisory system has been introduced by the General Electric Company, which provides for the centralized control and indication, over four wires, of various types of automatic switching equipment installed at outlying substations. Its principal advantage is the co-ordination of any number of units under the supervision of one dispatcher, which makes the equipment suitable for both large and small power systems. The control devices are so mounted that additions to the system can readily be made.

A new entrance fitting (Type "MF") has been announced by the Chicago-Jefferson Fuse & Electric Company,



The mechanism illustrated will operate valves automatically up to 6 in. in diameter

1500 S. Laflin St., Chicago. To assemble it the base is screwed onto the conduit. When the cap is removed, the wires can be pulled through the conduit with a straight-line pull. The wires are readily passed through the cover without extreme bending, and the cap is replaced. One brass screw which is not removable locks the cap cover and base firmly together. This fitting is made in ½-in., ¾-in., 1-in., and 1¼-in. sizes and has a galvanized finish. It is listed as standard by Underwriters' Laboratories.

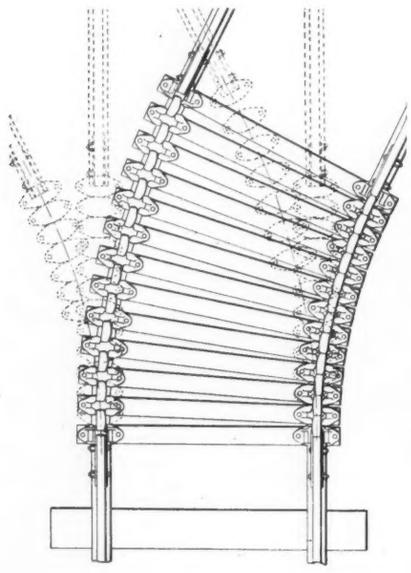
A Flow Meter of the Weir Type

Among instruments recently introduced for recording flow is the new V-notch recorder made by the Cochrane Corporation, Philadelphia. The problem of attaching the cam directly to the float stem so that it will push the pen sidewise the correct distance as the float rises has been met in this instrument in the following way: The cam is hung from pivot bearings and oscillates in a vertical plane, while a roller carried by the float stem and moving up and down in a straight line bears against the edge of the cam, approaching the axis or center of oscillation of the latter at the higher rates of flow. With this disposition of the parts, the manufacturer has found it easy to get the required transformation of motion with a cam of comparatively simple form. A slight biasing weight on the cam keeps it always in contact with the roller. The pen arm is attached directly to the cam spindle and the visible pointer is mounted on a separate spindle connected to the cam by a link motion. Operation of the integrator is controlled by motion received through a pair of toothed sectors.

Flexible Rail Facilitates Mucking

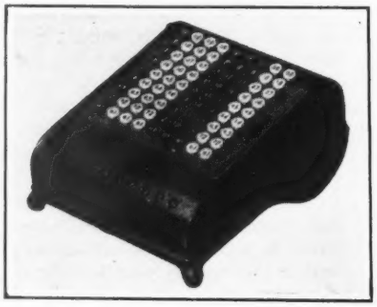
One of the accompanying illustrations shows the so-called Clarkson flexible rail, intended for cleaning wide places with only a single track. This device is made by the Illinois Power Shovel Company, Nashville, Ill., and was originally designed to enable a track-mounted machine to clean up a wide room. The rail as shown in the drawing is composed of small cast-steel sections with stop ears attached, which rest in chairs mounted on cross ties. Upon moving the track, the inside sections contract and the outside open out, forming a uniform curve.

Wide places can be mucked with a single track with aid of flexible rail



An Electrical Calculator for the Office

Electrical operation of a calculating machine reduces the actual physical effort on the part of the operator to a short depression of the keys, according to the Burroughs Adding Machine Company, which has just introduced a new model. In this the light key touch,



Only a light touch is needed to operate this new calculator

which is uniform for all keys, actuates the motor, which instantly completes the operation. Another advantage claimed is the positive key action. Errors due to incompleted strokes of the keys are said to be impossible because the operator cannot short-stroke or otherwise mis-operate a key. The calculator has a ten-column totaling capacity.

Extinguishing Fires With Carbon Dioxide

A new system of fire protection, employing carbon dioxide, is known as the Alfite system and is being offered to industry by the American-La France & Foamite Corporation. The gas is confined in a liquid state in metal cylinders, 51 in. high by 8½ in. diameter, under a pressure of 900 to 1,000 lb. When the system is brought into action, a plunger ruptures a copper disk used to seal the gas, and permits the gas to escape through piping to nozzles located at the scene of the fire. Here the gas is liberated into the room or space being protected, where it expands and dilutes the air so as to smother the flame. The system may be operated manually, semi-automatically, or automatically. The gas used is a special grade of carbon dioxide, especially pure and free from moisture, sulphur, dioxide, or other gas. Being a gas when freed, Alfite gas, as it is known, can penetrate every place where air can reach. Seventeen per cent of it in the air is sufficient to extinguish flames, but, as a factor of safety, the system is designed to provide 35 per cent dilution of the air in the space being protected. The gas is not poisonous and does not damage fabrics or machinery. The cylinders may be kept in cold places, because the liquefied gas does not freeze or deteriorate.

Another Hoist for Slushing

A new electric slushing or scraper hoist, recommended especially for use in iron and copper mines, has just been introduced by the Gardner-Denver Company, Denver, Colo. It is known as model EL-2. It is a double-drum hoist and is provided with suitable motors, for either a.c. or d.c. current, 25 to 60-cycle, and 220 to 550 volts.

Two Devices for the Shop

Electric Drill—Two high-speed light ¼-in. portable electric drills are now being made in quantity by the United States Electrical Tool Company, Cincinnati. One of these, known as the ¼-in. special direct-drive drill, operates directly on the armature shaft at a speed of 10,000 r.p.m., and weighs only 4 lb. The other, known as the ¼-in. special gear-reduction drill, operates at 2,000 r.p.m., and is only an eighth of a pound heavier. These machines are provided with keyless chucks.

Pipe Wrench—The Trimont Manufacturing Company, Inc., has introduced a new pipe wrench, in the manufacture and design of which an effort has been made to increase materially the strength and the element of safety. The contour of the frame has been slightly extended, but otherwise the appearance of the wrench is practically unchanged. The parts of the old and new wrenches are interchangeable throughout. Greater strength and toughness is obtained in the handle by heat treatment. As a further safeguard, overlapping side lugs, an integral part of the handle, brace the frame effectively against lateral distortion or spreading.

INDUSTRIAL NOTES

A boiler and power plant designed for 1,800 lb. pressure is to be built at Lockland, Ohio, by the Philip Carey Manufacturing Company, Cincinnati. The high-pressure steam-generating equipment is to be furnished by the Combustion Engineering Corporation, New York. Integral economizers, water-cooled furnace walls, air preheaters, superheaters, and pulverized-fuel equipment will comprise these units. The main generating units will consist of two 5,000-hp. vertical triple-expansion, direct-connected engines, operating with 1,400 lb. pressure at the throttle, at a temperature of 800 deg. F., and exhausting against 60-lb. back pressure above the atmosphere. To each engine a three-phase alternator will be connected. The main engines will be furnished by A. Borsig, of Berlin, Germany. The operating cycle of this plant, according to a recent statement, will make it one of the most efficient steam plants in the world.

H. E. Linden has been elected president and general manager of the American Paulin System, Inc. His headquarters will be at 1220 Maple Ave., Los Angeles.

NEWS OF THE WEEK

Summary

FOR the last eighteen months, South Africa has been considering the transportation of gold and diamonds by airplane. A start has already been made by the Union government in transporting the Namaqualand diamond output to Cape Town. Page 803.

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Reopening of three groups of old gold mines on the western slope of Gold Hill, Cripple Creek, Colo., by Secured Mining Corporation is proceeding rapidly. Shipments are made to Golden Cycle mill. Page 804.

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As a result of allegedly extravagant claims concerning ore reserves and concentrator construction, the British Columbia government has issued a report on the Snowflake and Waverley-Tangier mines, in the Revelstoke district. Page 802.

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A decision recently handed down by the Mexican Supreme Court in regard to the redenouncement of developed mining properties permits the government to lease the ground when proved reserves warrant such a step. Page 806.

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The Verde Central mill at Jerome, Ariz., will be completed about Dec. 1. Page 805.

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All operations at Tough-Oakes Burnside, in the Kirkland Lake district, have been suspended as a result of financial difficulties. Page 803.

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Hudson's Bay Company has lost its appeal to the Privy Council of the British Empire from the decision of the Canadian Supreme Court declaring that minerals in territory adjoining the company's posts belonged to the crown. Page 804.

* * *

Proposed abandonment of the branch railroad connecting the Ophir district of Utah with the main line near Tooele has not diminished activity in the district. Page 801.

Mine Rescue Work and Geophysics Affected by Radio Commission Activities

By Paul Wooton
Special Washington Correspondent

REQUIREMENTS of geophysical prospecting and of mine rescue work will be given the most sympathetic consideration in the allocation of short waves, the Federal Radio Commission announces. The whole question of short-wave assignment remains to be worked out. The commission heretofore has been occupied with the re-allocation of the long waves, but is now taking up the task of working out a policy for the handling of the short waves.

Radio waves are used in geophysical work to communicate between stations as to the way in which signals are passing through the earth of the area under investigation. As the radio provides practically instantaneous communication, it is an essential part of the measurement of the earth waves. It has been pointed out to the commission that electrical prospecting is carried on almost entirely in regions remote from commercial broadcasting stations and would be the cause of very little interference, particularly since a very small amount of power is used. Under no condition would more than 100 watts be wanted.

The Bureau of Mines has already conducted experiments looking to the use of radio communication with men underground. Though the results have not been encouraging, the increasing knowledge of radio leads to the hope that important use may be found for the radio in connection with rescue work. For these experiments the bureau would be willing to limit them to the hours least used for radio. The commission is asked, however, to take into consideration the possibility of the success of the experiments, and the desirability of allowing the exclusive use of suitable bands in case of emergency.

In addition to the application on behalf of the Bureau of Mines for the use of short waves for geophysical prospecting, various applications have been received by the commission from other applicants. They are: Geophysical Research Corporation, New York; Humble Oil & Refining Company, Houston, Tex.; Phillips Petroleum Company, Bartlesville, Okla.; The Texas Company, Houston; Geophysical Exploration Company, Beaumont, Tex.; McCullum Geological Explorations, Inc., Washington; F. Cushing Moore, Spokane, Wash.; and Interstate Geophysical Exploration Company, St. Louis.

Canada, Mexico, and Cuba also are much interested in the way the short waves are handled. Radio authorities of the three countries will meet in Ottawa Nov. 27 to confer on the subject.

Abandonment of Railroad Not Lessening Activity in Ophir

ALTHOUGH a petition for abandonment of the St. John & Ophir Railroad, which connects the Ophir district with the main line near the Tooele smelter of International Smelting, has been presented to the Interstate Commerce Commission, more work is being done in the district than in many years. Two years ago only two companies were operating in this old camp, but today a dozen companies are prospecting and developing claims.

Fisk Ophir Mines, adjoining Ophir Consolidated, has been re-equipped with compressor, electric power, and air drills. A tunnel is being driven 12 ft. a day, and two shifts are being worked. The operators hope to encounter the downward extension of the Green Monster and other productive fissures.

Ore is being taken from two levels in the Ophir Mono Mines, of which M. C. Godbe is president and manager. Two carloads were shipped recently. Operations at the Lion Hill shaft of Ophir Hill Consolidated have been stopped. Failure to find ore on the 1,400 level and a large flow of water recently struck caused a shutdown.

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Lead Association Is Formed

On Nov. 14, a new organization, Lead Industries Association, was organized by representatives of practically all the important lead mining and smelting companies of Canada, the United States, and Mexico, as well as one South American producer, and important lead manufacturing interests. The meeting was held at the Hotel Roosevelt, in New York. Clinton Crane was elected president, Hamilton Brush and R. M. Roosevelt, vice-presidents, and F. E. Wormser, secretary-treasurer. Details will be published next week.

Progress Made in Dispute Over Granby Power Supply

AT the request of the city of Grand Forks, B. C., which is concerned with Granby Consolidated Mining, Smelting & Power in the dispute about power and power rates with the West Kootenay Power & Light Company, Premier S. F. Tolmie invited the power company and the city to send representatives to Victoria to meet him and the Cabinet and to discuss the situation. The invitation was accepted, and, as a result of a two-hours' conference, the council for the power company announced that, at its next session, he would ask the Provincial Legislature so to amend the power company's charter that it legally may sell power outside of a radius of 50 miles from the city of Rossland. The company then will come within the jurisdiction of the Provincial Water Board, and that board will have power to adjust the rates. The West Kootenay company's directors have confirmed their council's announcement. The company will continue to supply power at existing rates outside of the 50-mile radius from Rossland, pending the amendment of its charter by the Legislature.

Oneco Stockholders Will Hold Meeting Nov. 20

INTEREST in idle properties in the Michigan district which are considered to have possibilities is reflected in the announcement of a special meeting of the shareholders of Oneco Copper Mining for Nov. 20 in Boston. The meeting is for the purpose of electing directors and of voting on the question of continuing the corporate existence of the company, the charter of which expires Dec. 23, 1928.

Oneco owns 800 acres east of the Franklin property. After some preliminary exploration, a two-compartment shaft was sunk 500 ft. in 1899. A fissure vein was cut in the shaft and an amygdaloid vein of fair width, containing copper, was opened by drifts in the upper levels. Work was suspended in 1900. In 1909, a drilling campaign was started and ten holes were bored, cutting the Oneco bed and an unidentified lode, both showing quantities of copper. The shaft was reopened in 1910 and deepened to 1,250 ft. Drifting was done from the 9 to the 12 levels, disclosing a well-mineralized vein, 10 to 12 ft. wide. The property was shut down in 1913 because of lack of funds.

French Company to Operate Russian Manganese Deposits

In Paris the "Société Internationale Fagbagan" has been founded to take over the former manganese concession fields of the Harriman interests at Tchiaturi. The former owners of the fields and Dutch bankers are included in the new company. The attitude of Soviet authorities is as yet unknown.

Investigation of Two British Columbia Mines Discloses Extravagant Claims

Government Inspection of Snowflake Mining and Waverly-Tangier Mines Shows Claims of Large Ore Reserves of Milling Grade Unjustified by Development

BECAUSE of the announcement of the development of vast ore reserves and intentions to erect huge concentrators by officials of the Snowflake Mining Company and of Waverley-Tangier Mines, W. A. Mackenzie, Minister of Mines for British Columbia, sent J. D. Galloway, provincial mineralogist, to make an examination and report of the Snowflake property, near Albert Canyon, in the Revelstoke division. A special report on the two properties may be obtained by applying to the Department of Mines, at Victoria, B. C. It contains reports on the Snowflake property, by J. D. Galloway, provincial mineralogist; A. G. Langley and B. T. O'Grady, resident engineer and assistant resident engineer, respectively, for No. 5 Mineral Survey district; and two reports by F. W. Guernsey, consulting engineer for the Snowflake company; and a report by B. T. O'Grady on the Waverley-Tangier properties, 21 miles from Revelstoke.

The reports of the several engineers agree. That of the company's consulting engineer, as might be expected, is more optimistic as to the possibilities of the Snowflake property than are those of the provincial mineralogist and the resident engineers. Only No. 1 vein has been explored to any extent. A little ore has been shipped from openings on the vein, and some ore still remains in the vein, but, the reports agree, no appreciable tonnage of milling ore has been developed. The vein has been opened by a 900-ft. tunnel at a depth of about 600 ft. on the dip of the vein, and the tunnel has pierced 45 ft. 9 in. of material, only two sections, 6 ft. 10 in. and 4 ft. wide, respectively, of which Mr. Galloway considers to be true vein matter. These sections are composed of quartz and carry no minerals of commercial value. The engineers agree that by driving on the vein, shoots of commercial ore may be found.

This is an entirely different tale to that circulated by officials of the company—that the tunnel had cut an orebody more than 40 ft. wide, 17 ft. 8 in. of which was composed of milling ore. All engineers agree that at its present stage the Snowflake is only a prospect; some are less enthusiastic than others as to its promise as a prospect.

Mr. O'Grady finds that a much larger tonnage would have to be developed at the Tangier property, and that a satisfactory method of treating the ore must be devised, before the erection of a concentrator would be justified.

The most important feature about the special report issued by the Department of Mines is that it clearly shows that the Minister of Mines will not tolerate false statements, issued for the purpose of deceiving the public. This should assure investors in British Columbia mineral lands, if they are willing to seek information from the Department of Mines before venturing their capital.

Jack Waite Strikes High-Grade Ore in Drift

DRIFTING from a raise, 30 ft. above the tunnel level of the Jack Waite Consolidated mine, in the Coeur d'Alene district of Idaho, recently struck a 7-ft. vein of high-grade galena ore, according to M. L. Savage, manager of the company. The face of the tunnel is in high-grade concentrating ore. It has followed ore for the last 900 ft. The remodeled concentrator of the company has produced about 20 carloads of lead concentrate, averaging $65 a ton. Production will not be affected during the period of enlarging the mill capacity. Mr. Savage expects to have the new equipment installed before Christmas. At present 55 men are employed.

New Dredge at Junction City

At Junction City, Trinity County, Calif., Madrona Dredging expects to complete the construction of its gold dredge late in December. The company controls a 400-acre dredging area above Junction City.

Four Aces Promoters Will Not Serve Prison Sentences

In the Los Angeles, Calif., Superior Court fines of $5,000 each were imposed upon L. R. Longnecker and J. W. Garrity for violation of the corporate securities act in connection with the sale of stock in the Four Aces Mining Company, a Nevada incorporation. Prison sentences of one to ten years each were suspended and the convicted men were ordered to return to the company $980,000 in cash and stocks which were found in their possession.

Goldfield Deep Developing Ore on 2,150 Level

Two drifts are now being driven on the 2,150 level of Goldfield Deep Mines, in the Goldfield district, Nevada. Small bodies of ore, said to assay $40 a ton in copper and gold, have been found at this level. The drifts have, as their objective, a supposed fault running east and west through the property, beyond which the management expects to find enlarged orebodies leading toward the workings of Goldfield Consolidated.

Transportation of Gold and Diamonds by Airplane Practicable in South Africa

By Owen Letcher
Special Johannesburg Correspondent

FOR the last eighteen months the transportation of South African gold and diamond production by air has been freely discussed and, at least as far as diamonds are concerned, a definite start has been made by transporting diamonds recovered from the government diggings at Alexander Bay, Namaqualand, to Cape Town by means of government-owned planes. Already many thousands of pounds' worth of diamonds have been sent in this manner.

The utmost secrecy prevails in regard to the government's operations at Alexander Bay. Even the values of the stones recovered to date are being jealously kept secret, but it is safe to assume that they are quite large. The manner of transportation from this bleak and inhospitable spot to the Union Government's diamond department strengthens this assumption.

As for gold, the use of airplanes has not yet taken place, but the acquisition of an area of ground suitable for an airdrome at Germiston, close to the Rand refinery, where nearly 11,000,000 oz. of gold is handled every year, indicates that the gold-mining industry is becoming "air-minded."

Although the Chamber of Mines does not see any immediate prospect of utilizing airplanes for the conveyance of gold, it has made provision for future developments by obtaining a share in the control of the airdrome. The ground, totaling 400 acres in extent, is held by Elandsfontein Estates, the third party to the negotiations for the airdrome. The suggestion was made by the latter that the ground be taken jointly by the Rand Refinery, the Germiston Town Council, and itself, operations to be conducted on an equal basis by all three.

Transporting gold from some of the Rhodesian mines by air has also been discussed, and in the Belgian Congo it is proposed to establish airplane service for the transportation of the produce of the Kilo-Moto gold fields.

Later, once the South African platinum industry becomes established on a larger production basis than at present, this valuable metal may likewise be transported by plane.

California-Ahumada Obtains Funds for Development Work

A CHANGE of control of the California-Ahumada Mining Company's properties is in progress. The properties are prospects 65 miles south of El Paso, Tex., and comprise some 393 acres in the Cerros Colorados, Villa Ahumada, Chih., Mexico. The company was formed by H. A. Houser in 1926 after Houser and his associates had opened up and prospected the California claim in a preliminary way. Work on company account was started early in 1927.

Lack of funds restricted operations considerably, and finally, after negotiations, the Pardners Mines Corporation, of which H. E. Talbott, Jr., is one of the principals, agreed to purchase 200,000 shares of the treasury stock, the proceeds to be expended for equipment and development, and the corporation is also to be given options upon additional blocks of treasury stock. Company stock, personally owned, to the amount of 351,000 shares, is to be escrowed subject to option of purchase by Pardners Mines Corporation. Upon the consummation of the escrow the work of exploration is to be started and continued with expenditures of from $4,000 to $5,000 per month.

Hollinger Loses Appeal in Conveyor Taxation Suit

HOLLINGER Consolidated has lost its appeal against the decision, made by the court at Temiskaming, Ont., which held the company liable for municipal taxes on the conveyor used for carrying sand to its property at Timmins. The appeal was heard before the Ontario Railway and Municipal Board. Under the provincial assessment act, all buildings and machinery used in mining are exempt from municipal taxation, but the decision of the Temiskaming court was that the system used by Hollinger to convey sand to the mine from a point, 3½ miles distant, not being on or under the mineral lands of the company, was liable to assessment. The conveyor system is valued at about $90,000.

Katherine Gold Starts Drift

Katherine Gold Mines has started to drift on the 600 level of its mine, in the Kingman district of Arizona. Recent diamond-drill results on this level indicated a vein, 20 ft. wide, carrying ore of a good milling grade. Another orebody was recently found on the 300 level, and development at this point is also under way.

Tough-Oakes Suspends Operations at Kirkland Lake

TOUGH-OAKES Burnside Gold Mines, gold producer in the Kirkland Lake district of northern Ontario, has suspended operations because of financial difficulties. Alan Stuart, manager of the property, states that he is awaiting word from London. Of the $400,000 raised by issuing 7 per cent 5 year notes in 1927, $280,000 has been spent. Current liabilities amount to between $25,000 and $30,000 and carrying charges at the property will amount to about $1,000 a month. It is not believed that any underground work will be done during the winter.

Tough-Oakes was the first producing mine in the Kirkland Lake district. It was then known as Tough-Oakes Gold Mines. In 1923, the property was consolidated with Burnside Gold Mines, and the present company, capitalized at $5,000,000, was formed. For a time it seemed as if the mine had a profitable future, but the gold content dropped to $7 a ton, and operations were conducted at a loss. The shaft was sunk from the 1,345 level to the 1,975 level in the hope of finding more consistent ore at depth, but evidently this hope has not been fulfilled.

The company's properties consist of ten claims, totaling 313 acres, located on the east end of the main "break" of the Kirkland Lake district. Equipment includes a 175-ton mill.

Shaft at Silver Reef Is Being Sunk Rapidly

SHAFT-SINKING at the Silver Reef property, in Washington County, Utah, had reached a depth of 288 ft. at midnight on Oct. 31. During October the shaft was lowered 126 ft., according to A. H. Means, manager of the Western mining department of American Smelting & Refining, which controls the property. Operations are in charge of C. C. Cushwa, superintendent.

A station will be cut at the 300 level and a sump sunk so that water can be lifted from the 300 level to the surface. The three-compartment shaft will be sunk to about 550 ft. and drifting will be started to the Buckstone reef to ascertain if the deposits, which produced about $8,000,000 worth of silver in the 'seventies, extend to depth.

Claims at Gold Lake Bought by Northern Aërial Minerals

Northern Aërial Minerals Exploration has purchased a 90 per cent interest in the Smith-Watson property, consisting of twelve claims, at Gold Lake, Patricia district, northern Ontario. The property carries gold, occurring in a porphyry formation. Development will be begun immediately. Working forces and supplies will be brought from Sioux Lookout by airplane. The company will establish an assay office at Sioux Lookout to test the ore from its Gold Lake and other properties.

Papers Presented at Meeting of Salt Lake Sections of A.I.M.E. and American Chemical Society

"Measurement of Hydrogen-Ion Concentration." By Dr. Thomas B. Brighton, professor of chemistry, University of Utah.

"The Influence of Hydrogen-Ion Concentration on Recovery in Simple Flotation Systems." By A. M. Gaudin, associate professor of metallurgical research, University of Utah.

"Oxidized Ore Flotation at the Chief Consolidated Mill." By G. H. Wigton, metallurgical engineer, Chief Consolidated Mining Company.

"Control of Alkalinity and Its Effect on Flotation." By H. S. Martin, metallurgical engineer, Arthur Plant, Utah Copper Company.

"The Silver-Bearing Minerals of Some Tintic Ores." By A. W. Hahn, consulting metallurgist, Salt Lake City.

Hudson's Bay Company Loses Appeal for Mineral Claims

GOLD and silver in Hudson's Bay Company lands is owned by the crown in the right of the dominion government under a ruling of the judicial committee of the Privy Council at London, handed down on Nov. 9, according to Associated Press dispatches. The appeal of the company from the Canadian Supreme Court's decision was dismissed.

The Hudson's Bay Company received a charter in the days of King Charles II, giving it absolute ownership of a vast territory around Hudson Bay. A few years after Canada became a dominion, however, the company surrendered this area in return for western lands.

Since the discovery and exploitation of the gold and silver deposits in northern Canada, the company has claimed that, though it surrendered ownership of the territory, it retained ownership of precious metals in the land occupied by it at its trading posts and adjoining the trading posts.

Will Consider Restriction of Mexican Immigration

On Nov. 21 the House Committee on Immigration will meet at Washington, D. C., to consider a bill proposing restriction of Mexican immigration. This bill was under consideration at the time that Congress was adjourned last May. At that time Secretary of State Kellogg opposed it on the grounds that it might cause retaliatory action on the part of Mexico and that American companies operating there might suffer from a lack of technical men.

Old Cripple Creek Mines Are Being Reopened Rapidly by Secured Mining

REOPENING of the Anchoria-Leland, Midget-Bonanza King, and Conundrum mines, on the western slope of Gold Hill, Cripple Creek, Colo., by the Secured Mining Corporation is proceeding rapidly. This company was formed recently in Colorado by J. A. F. Durocher-Stone, of New York, who is now its president, to take over the properties which had been purchased by Mr. Durocher-Stone early in July. John Tait Milliken is the chief mining engineer of the company.

Shipments of from three to six carloads of ore are being made daily to the Golden Cycle mill at Colorado Springs, most of these shipments coming from the Midget-Bonanza King dump. The Midget shaft, including air lines, has been completed below the No. 4 level, according to Mr. Milliken, and production from this shaft, which is approximately 800 ft. deep, should start early in December. A new motor has been installed for hoist operation. About 200 ft. below the bottom workings of this mine a high-grade orebody has been intersected by a drift driven from the Conundrum shaft on the C-10 level. A prospecting drill is being used to explore the vein systems of the Midget and Anchoria-Leland properties, higher up on Gold Hill.

The Conundrum shaft has been repaired. Track and air lines are being laid on the No. 5 level of this shaft, preparatory to production. New ore has been opened south of the Conundrum shaft and between the Conundrum basalt dike and a phonolite dike. The vein is about 6 ft. wide. The Nos. 7 and 9 levels will be opened after work on the No. 5 is completed.

The Anchoria-Leland mine will be prepared for production as soon as the work at the Midget is completed. A tram has been constructed connecting the Midget-Bonanza King shaft, the Midget dump, and the Conundrum shaft to the Midland Terminal Railroad. This construction has enabled a large saving in transportation costs. Charges for tramming from the Midget and Conundrum mines are 5c. a ton or less, as compared with 65c. a ton paid by the former owners for transportation by truck to the same point on the railroad. The present shipments of about 125 tons a day will probably be doubled when production is started from the Midget.

Canadians Developing Two Old Mines in Wallapai Mountains

TWO mines in the Wallapai Mountains of Arizona, which were producers in the latter part of the nineteenth century, are being developed by Canadian capital, represented by H. L. Phillips, local mining engineer. Democrat Mines, Ltd., has been formed with a capital of 2,500,000 shares of no par value to operate the Democrat group, consisting of 22 claims about 17 miles from Kingman. The Democrat was worked for its silver-gold ore in the 'seventies, shipments being made to the Swansea smelter, in Wales, via San Francisco. A tunnel has been driven for 900 ft. along a vein, which has outcroppings for a total length of 7,500 ft. The ore shows some lead and zinc in addition to the precious metals. A road will be built to the property connecting it with the main road into Kingman, and bunkhouses for 30 or 40 men.

At the Alpha mine, in the same district, ore is being extracted from the lower tunnel at a point about 800 ft. from the portal. Copper ore is being separated from lead-zinc ore, and will probably be sent to the American Smelting & Refining smelter at Hayden, Ariz. Lead-zinc ore is being piled on the dump, preparatory to construction of a mill. Mr. Phillips is acting in a consulting capacity. Considerable development work is being undertaken, including driving a crosscut from the lower tunnel to the Wallapai Queen vein.

The Alpha mine shipped ore to the Salt Lake plants in the 'eighties, but the complex formation of the ore, which contains the five major non-ferrous metals, made profitable treatment with the limited metallurgical knowledge of the time impossible.

Diamond Drill Cuts Extension of Dambo Lode

DIAMOND drilling by Rhodesian Congo Border Concessions on its concession west of the N'Changa Copper Mines, Ltd., boundary, has cut the extension of the Dambo lode, according to H. C. Hankins, secretary of both companies. The diamond-drill hole was put down approximately 820 ft. west of the N'Changa boundary and cut ore at a depth of 140 ft. The drill continued in ore for 80 ft., with an average assay of 3.33 per cent copper. Average dip of the lode at this point was 8 deg.

At the N'Changa property, which is controlled by Rhodesian Congo, underground development work done during the three months ending Sept. 30, 1928, totaled 3,460 ft. On the 300 level of the main shaft, the main crosscut exposed 50 ft. of ore, of irregular content, and then 70 ft. of ore averaging 4.71 per cent copper. The drive east and west along the strike on this level has exposed 240 ft. of ore, averaging 4.08 per cent copper.

Four diamond-drill holes, scattered for a distance of 4,500 ft. along the Dambo lode, have cut 170, 130, 80, and 90 ft. of ore, averaging about 4.5 per cent copper. The greater widths were obtained at the more westerly holes.

Reopen German Bar Mine Near Auburn, Calif.

GERMAN Bar Gold Mines has purchased the German Bar property and three adjacent claims in the Alleghany mining district of Sierra and Nevada counties, California. Thomas E. Stevens, California mining engineer, who recently returned to the United States after 17 years in Argentina, has assumed the management of the property, with headquarters at Auburn, Calif. The property is opened by four tunnels and has produced approximately $200,000 in gold. Roads have been built to the mine, surface buildings and equipment have been installed, and an initial milling unit, involving amalgamation and table concentration, will be installed by spring. The property is on an extension of the vein in the adjoining Irlan property, and is in the same district as the Gold Canyon and Plumbago properties. It was last operated about 1913, when high-grade ore was mined and reduced in hand mortars.

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Metal Mining Had Lower Accident Rate in 1927

THE metal-mining industry in the United States had fewer deaths and injuries from accidents to its employees in 1927 than 1926, according to a study of reports from operating companies recently completed by the U. S. Bureau of Mines. Death rate was reduced from 3.47 per thousand employees (300-day employees) in 1926 to 3.10 per thousand in 1927, and the non-fatal injury rate was reduced from 245 to 222 per thousand employees.

Death rate in copper mines was substantially the same as in the previous year, but the injury rate was reduced 9 per cent. In the iron mines reductions of 14 per cent in the injury rate and 42 per cent in the death rate were effected; the large reduction in the death rate was to be credited largely to the fact that the rate for 1926 was abnormally high because of a single disaster in which 51 lives were lost. Lead and zinc mines in the Mississippi Valley States lowered their fatality rate 13 per cent and their injury rate about 2 per cent. A reduction of 7 per cent in the injury rate was shown for mines producing gold, silver, and miscellaneous metals, but the death rate for this class of mines was 20 per cent higher than in 1926. Mines producing non-metallic minerals showed a reduction of 16 per cent in the fatality rate and 10 per cent in the injury rate.

According to reports by operating companies, the metal-mining industry in the United States in 1927 employed 119,699 men, who worked 34,033,963 shifts, an average of 284 shifts per man. The number of men killed in the entire industry was 352 and the number injured 25,133, including all injuries disabling an employee for more than the remainder of the day on which the accident occurred. The number of men employed and the number of man days of labor performed in 1927 were somewhat less than in 1926, when 127,823 men worked 37,160,978 shifts. There were 430 deaths and 30,350 non-fatal injuries in 1926.

Of the 119,699 men employed, 73,185 worked underground, 15,933 in open pits, and 30,581 were employed at surface shops and yards. The number of shifts worked underground was 21,392,033; in the pits, 4,056,705; and 8,585,225 on the surface.

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Government Brings Idaho Copper Men to Trial

GEORGE GRAHAM RICE; his brother-in-law, Frank Silva; Walter K. Yorston, a promoter; and Walter Harvey Weed were placed on trial on Nov. 13 before Federal Judge Knox, in the federal court at New York, on a charge of fraudulent use of the mails in the sale of the stock of the Idaho Copper Corporation. The corporation publishing *The Wall Street Iconoclast,* a publication controlled by Rice and alleged to have been used by him to solicit investors, was also named as a defendant.

In the examination of a panel of 150 veniremen on the opening day of the trial, the panel was exhausted and still only eleven jurors were picked.

Verde Central Mill Expected to Be Ready About Dec. 1

OPERATIONS at the new 300-ton concentrator being built by Verde Central Mines in the Jerome district of Arizona are expected to start about Dec. 1. The company, which is a subsidiary of Calumet & Arizona, is said to have proved about 800,000 tons of 4 per cent copper ore, but additional reserves will be needed to insure profitable operation. The accompanying illustration shows the mill building on Oct. 15, about four and a half months after construction was started. The building is 160x70 ft., and is situated about 600 ft. from the shaft collar. Concentrates will be smelted at the United Verde Extension smelter, at Clemenceau. R. H. Dickson is general manager of the property.

Cedar Creek Ships Ore to Bunker Hill Smelter

Cedar Creek Mining & Development made the first shipment of concentrate from its 100-ton mill, in the Cœur d'Alene district of Idaho, on Nov. 7. The mill started operations about three weeks ago and is now handling about 70 tons a day. Two shifts are being worked. The concentrate is transported by truck to Pritchard, 12 miles distant, whence it is shipped by train to the Bunker Hill & Sullivan smelter.

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Cuba Mine, Near Ely, Resumes Ore Shipments

SHIPMENTS of lead ore from the old Cuba mine, in Steptoe Valley, Nev., 35 miles northwest of Ely, have been resumed. The ore goes to the Midvale (Utah) plant of U. S. Smelting Refining & Mining. John Smith, of Ely, is in charge of operations, and Thomas Wilson, of Ogden, Utah, is financing the development.

A tunnel is being driven to cut the vein 500 ft. below the old workings. High-grade ore is shipped direct. Milling ore is jigged at the Campbell ranch, two miles distant. A bunkhouse is being erected at the property.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Peterson Cobalt Mine Will Be Reopened—New Company to Work Manitoba Tin

TORONTO, Nov. 10, 1928.—The Peterson Cobalt mine, consisting of 224 acres adjoining the Nipissing mine at Cobalt in northern Ontario, will be reopened, according to an announcement made following a directors' meeting recently in Toronto. The mine has been kept unwatered, and it is expected that it will soon be ready for production. The company, which was organized in 1926 to succeed Peterson Lake Silver-Cobalt Mining, owns a 100-ton mill and two-thirds of another plant with 200 tons' capacity.

Jack Nutt Mines, Ltd., has been organized, with a capital of 5,000,000 shares of no par value, to acquire a number of claims in the Herb Lake area of northern Manitoba, including the Lucky Jack, Broad Bay, Wekusko, and other groups on Little Herb and Wolverton lakes. The company has also obtained control of fifteen claims in the Shatford Lake district, east of Lac du Bonnet, where discoveries of tin have been reported. A. J. Merrill, mining engineer, of Winnipeg, is now examining the property with a view to diamond-drilling operations.

AT THE request of the Ontario Department of Mines, the Department of Forestry will keep four of its wireless stations open all winter, thereby insuring quick and unbroken communication with the mining camps in the Patricia district. The stations are at Sioux Lookout, Gold Pines, Woman Lake, and Red Lake. Arrangements have been made by the Ontario government and the Canadian National Railways whereby telegrams will be relayed to and from the mining centers by these stations.

An orebody about 250 ft. long and 8 ft. wide has been exposed on the 733 level of the Vipond mine, in the Porcupine district, R. E. Dye, manager of the property, said at the recent annual meeting of the company in Toronto. On the 600 level, ore of a similar character and better grade has been exposed for 30 ft. An exploratory crosscut is being driven on the 633 level to explore the porphyry contact in the western part of the property.

An issue of 100,000 shares of stock in Falconbridge Nickel, the company being formed by the Lindsley interests, which control Sudbury Basin and Sherritt-Gordon, to take over a group of nickel claims in the Sudbury district, was heavily oversubscribed at $5 a share. A shaft is now being sunk on the Longyear claims, where drilling is said to have proved an ore zone 6,500 ft. in length. These claims were acquired by Sudbury Basin Mines and have been turned over to the new company.

Crosscutting at the property of Murphy Mines, in the Kirkland Lake district, has confirmed diamond-drilling results on the 100 level. The mineralized zone is about 40 ft. wide on this level. Diamond drilling has struck the same orebody at a depth of 350 ft. Another drill hole will be put down from a point 500 ft. east of the shaft in an effort to strike the orebody at 500 ft.

Old Welsh Copper Mines Will Be Reopened

REOPENING of the Parys Mountain copper mines, in Anglesea, Wales, will be started soon. It is reported that new veins of copper ore have been discovered over a length of 1,000 ft., averaging 3 per cent copper. The mines at Anglesea were first worked during the Roman occupation of Britain. Extensive exploitation first started in 1758. Records show that more than £7,000,000 was paid in dividends from the working of these mines.

Two More Drills Started in Champion Exploration

TWO more drills have been started in Champion Copper's exploratory tract, equally owned by Copper Range and St. Mary's Mineral Land, making a total of three drills now in operation. This work is being done by the E. J. Longyear Company, of Minneapolis.

At a depth of about 600 ft., the first drill has cut three lodes of the Atlantic or Ashbed series, one more than was expected. Although some copper has been disclosed, the results are almost negative commercially, but not altogether discouraging. The metal is not in the rock itself, as was characteristic of the Ashbed in the old Atlantic property, but occurs only here and there in calcite deposited in the amygdules.

The first hole has shown the value of the magnetic dip-needle survey, which accurately defined the trend of the beds. It has given the required bearings and made possible the advantageous location of the two additional drills. The first hole is going down about 2½ miles southwest of the old Atlantic mine. The two additional drills have been started closer to the lodes, and should strike them nearer surface. This will result in a saving of time and money, for which the preliminary dip-needle work is entirely responsible. The new drills are about a half mile on either side of the first hole. The first drill now is being driven deeper to cut the Pewabic bed, which should be penetrated at a depth of between 1,200 and 1,500 ft. After cutting through the Ashbed series, the two additional drills will be driven deeper to tap the Pewabic.

Mexico City Letter

BY W. L. VAIL
Special Correspondent

New Ruling Made by Supreme Court on Denouncement of Developed Properties

MEXICO CITY, Nov. 6, 1928.—The Supreme Court of Mexico has recently made a ruling which is regarded as of extreme importance in the interpretation of the new mining law. It states, in effect, that when additional development is in evidence on mining properties, such properties are not open for denouncement in the same manner as new ground, but are subject to lease by the government. The ruling in question was handed down during mandamus proceedings against the Department of Industry, Commerce, and Labor, which had refused to grant title on the redenouncement of certain properties in the State of Zacatecas. The mining division of the department insisted that these properties had acquired a value, as a result of development, incompatible with their being granted through denouncement. This opinion has been sustained. A number of similar cases have arisen since the new mining law went into effect, but this is the first case which has been carried through to the Supreme Court.

H. W. FOWLER, general manager of Chontalpan y Anexas, reports that both the flotation and cyanide plants at the Chontalpan and Xitinga mines, in the State of Guerrero, are now working satisfactorily. Because of mechanical difficulties in the cyanide plant, it was closed for some time while modifications of the original flow sheet were effected, but it is again in operation and making a recovery of approximately 85 per cent. Output of the Xitinga mine has been considerably increased by opening three new levels.

At the Mesquital del Oro mine, in the State of Zacatecas, about 125 men are employed. Bullion from this property now controlled by Pacific Mining is transported from Guadalajara by airplane, the second service of this sort established in the republic for freight purposes. W. H. Mitchell is in charge of operations of the company, which is controlled by Canadian interests. The Spada mine, owned by William Thompson, is producing again. This property had been closed for some time.

Reports are current to the effect that the Palenque mine, in the Vetagrande district of Zacatecas, will be reopened soon. The property is equipped with a small flotation plant for the treatment of silver-gold ore. It is owned by Mexican interests.

Cinco Minas, State of Jalisco, is producing about 600 tons of silver-gold ore daily. Differences with the laborers, which became serious during 1927, appear to have been satisfactorily settled.

Recent Technical Publications

Kraus and Hunt Revised

MINERALOGY. An Introduction to the Study of Minerals and Crystals. By E. H. Kraus and W. F. Hunt. Second Edition. McGraw-Hill Book Company, New York. Pages 604; illustrated; price $5.

THE popularity of the first edition of this standard textbook is attested by the fact that it passed through four printings. The second edition retains the attractive features of the first, with the addition of two new chapters, and improvement by revision and correction, where needed, of the old chapters. The new chapters discuss crystal structure and X-ray analysis. The quality of the illustrations was an outstanding feature of the first edition. These have been supplemented by others, bringing the total to 766, including photographic perspectives of crystal models. The result is such that the book is assured a cordial reception by students and practical men as well as by the engineer whose ability for spotting and cataloging the formidable sounding hemiorthodomes, dyakisdodecahedrons, hexagonal bipyramids of the first order, and others of their ilk, may not be as acute as it was in his undergraduate days.

The book will continue to exert a beneficial influence in the appropriate development of embryo geologists, mineralogists, and technicians. Not as exhaustive or as voluminous as Dana, nor as compact or concise as a handbook such as Butler's, nevertheless it fills that important middle ground satisfactorily, for it combines most adequately many of the important advantages of each. H. L. J.

FLOTATION PRACTICE. Papers and Discussions presented at meetings of the A.I.M.E. in Salt Lake City in August, 1927, and in New York in February, 1928. American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York.

THIS series of twenty-five papers, all by prominent members of the profession, is hardly a textbook, although the student of flotation will find much wherewith to supplement his elementary knowledge. For the most part, the individual papers deal with the practice at some particular plant or district. A paper defining flotation and discussing its present status and its future, by Ernest Gayford, properly heads the series. Flotation and lead smelting, in three phases of the latter, are covered as follows: roasting and sintering, by W. H. Eardley; the blast furnace, by R. A. Wagstaff; zinc and fluxes, by A. B. Young. The effects of selective flotation on copper smelting are discussed in a paper by B. L. Sackett. Paul Billingsley treats the subject of how flotation has broadened the geologist's viewpoint. Flotation reagents are covered by A. F. Taggart and their functions by A. M. Gaudin. The metallurgist will find it convenient to have this collection of related papers.

CANADIAN MINING MANUAL, 1928. Industrial and Educational Publishing Company, Ltd., Gardenvale, Quebec, Canada. Compiled and edited by Reginald E. Hore. Five hundred and sixty-four pages.

THIS volume is a compilation of interesting articles on Canadian mining and metallurgical practice and on the mineral resources of the Dominion. Many sources have been drawn upon to produce a work that will be valuable to anyone having occasion to study any of the phases of Canada's mining industry. Practically every phase of technical operation is covered, including that of geophysical prospecting, to which considerable space has been devoted in the evident desire to satisfy the current demand for information. Equipment has not been neglected, an appreciable number of pages being devoted to a discussion of various types of rock drills and other mining machinery. On the whole, the new volume will serve as a convenient reference library for anyone who is likely to need information on Canadian practice.

INTERNATIONAL TRADE IN STAPLE COMMODITIES. By E. E. Pratt. New York: McGraw-Hill Book Company. Pp. 570; price $5.

AS STATED in the preface, this volume is the outgrowth of a series of lectures given at the School of Business, Columbia University. The purpose of the book is to explore a comparatively new field in international trade, to arouse interest in world commerce and to furnish material to be used for training men and women who wish to enter this department of business. International trade in staple commodities, it is averred, is, in many respects, essentially different from international trade in manufacturing commodities. The book demonstrates general tendencies and does not pretend to claim timeliness or accuracy "to the last hour or to the last digit." The commodities dealt with comprise cotton, wool, silk, jute, rubber, wheat, sugar, tea, coffee, Chilean nitrate of soda, coal, petroleum and petroleum products, and lumber.

MINING METHODS AT BRITANNIA. In the *Canadian Mining and Metallurgical Bulletin* for November, J. I. Moore, Jr., gives a concise description of the various mining methods used by the Britannia Mining and Smelting Company, British Columbia. To permit a clear understanding he also describes the ore deposits briefly. Many different methods have been and are being used at this property. The selection is governed by (a) character and hardness of ore and walls, (b) mining with or without timber, (c) value of ore per ton, and (d) waste filling. Methods described include shrinkage stoping, modified shrinkage, glory-hole mining, rill stoping, and the timbered rill. The use of powder winzes, located adjacent to large open stopes or glory holes, for the purpose of breaking ground that would be difficult and expensive to mine otherwise, is also described. These winzes are from 20 to 40 ft. deep, usually enlarged at the bottom, and carry charges of ½ ton to 2 tons of powder. As nearly as could be determined such blasts have broken from 4 to 10 tons of ore per pound of powder.

The same issue of the *Bulletin* contains an article describing the precipitation of copper from mine waters at the Britannia mines. This is written by F. Ebbutt and W. E. Selnes, of the Britannia company's geological department.

REFRACTORIES — Two University of Illinois bulletins dealing with the subject of refractories have recently come to hand. One of these, containing 30 pages, is entitled "The Thermal Expansion of Fireclay Bricks," and is by Albert E. R. Westman. It is known as Bulletin No. 181. The other, Circular No. 17, is entitled "A Laboratory Furnace for Testing Resistance of Firebrick to Slag Erosion," and is written by Ralph K. Hursh and Chester E. Grigsby. They may be had at the price of 20c. and 15c. respectively, by applying to the Engineering Experiment Station, University of Illinois, Urbana, Ill.

Government Publications

The following bulletins have been received recently from the U. S. Bureau of Mines:

"Feldspar in 1927." By Jefferson Middleton. An advance chapter of "Mineral Resources of the United States, 1927—Part II." Price 5c.*

"Potash in 1927." By A. T. Coons. An advance chapter of "Mineral Resources of the United States, 1927—Part II." Seven pages; price 5c.*

"Copper in 1926, General Report." By C. E. Julihn and Helena M. Meyer. An advance chapter of "Mineral Resources of the United States, 1926—Part I." Fifty-six pages; price 10c.*

"Determining the Air-Flow Resistance of a Small Shaft Mine by Natural Draft." By G. E. McElroy and A. S. Richardson. Serial No. 2890, Reports of Investigations. A 50-page multigraphed bulletin.

"Gold, Silver, Copper, Lead and Zinc in the Eastern States in 1927—Mine Report." By J. C. Dunlop. An advance chapter of "Mineral Resources of the United States, 1927—Part I." Six pages; price 5c.*

*Sold only by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

MARKET AND FINANCIAL NEWS

Berlin Financial News

By Dr. James Rubinfeld
Special Berlin Correspondent

THE German Copper Institute, which was organized mainly on the plan and scope of the American Copper and Brass Research Association and also received financial assistance from American copper interests in February, 1927, recently held its second general meeting. Hopes of popularizing copper in Germany again, to replace the many substitutes which have come about in times of war and inflation, have been encouraged, according to the report released by the management of the institute. A great many new uses are consuming large tonnages of copper, especially in the building industries. Contrary to American practice, an attempt is being made to oust brass tubes by copper tubes, and to increase the consumption of copper in higher-grade automobiles. On the board of the institute are representatives of the Metallgesellschaft, the Mansfeld, and the A.E.G., among others.

Semi-official communications concerning the development of modernization in operations at Giesche Spolka Akcyina effected by the Anaconda company state that the amount of American capital contributed to the undertaking has been $7,250,000. Rebuilding of retort plant of Uthemann-Bernhardi and Trzebinia smelters has required $992,000, and the rate of output has already been increased to 4,500 metric tons of slab zinc per month. Zinc (as well as lead) ores are derived from the Bleycharley mine, and are being treated by the new "Waelz" volatilization process, the capacity being 600 tons daily. An electrolytic plant to be operated in conjunction with this process has been erected near the Bernhardi smelter at a cost of $1,160,000. It will have a capacity of 60 tons of electrolytic zinc per day. Electrical power is secured from the Karmer works, the output of which has been increased to 29,000 kw. from the original 13,000 kw. output. American methods of flotation and concentration treatment are to be installed.

Metal imports into Germany within the first nine months of 1928 are reported by the official statistical board of the republic as follows:

German Metal Imports, January-September
In Metric Tons

Aluminum	11,289	8,000
Lead	113,129	117,063
Zinc	107,528	110,459
Tin	9,812	11,348
Nickel	3,331	2,578
Copper	180,684	172,785
Antimony	2,762	2,547
Silver	170	320

German aluminum exports to the United States, which formerly had accounted for a considerable part, and had sometimes exceeded a third, of the whole production, have declined this year as a result of the reduction of domestic prices by the Aluminum Company of America. Within the European Aluminum Cartel, firm sales quotas and prices are established for participating nations, and consequently Germany has been forced to take part of the excess outputs of France, England, and Switzerland this year. The resultant effect on the German industry has not been beneficial.

Development of the Hungarian bauxite industry is proceeding apace, with the active help of German aluminum works (through Bauxite Trust A.G. of Zurich) and the Otavi company. The erection of an aluminum plant in Hungary is now being seriously considered by industrialists there, and plans are being studied to extend exports of bauxite, which thus far has gone largely to Germany—for instance, 231,425 tons in the last year from the total Hungarian production of 287,954 tons. Hungary is able to deliver 25 per cent of world aluminum requirements. She has rich mines that are easily worked.

The Turkish Mining Company has obtained a concession from the Turkish government to prospect the chromite mines of Bosular (a village of Brussa) and Kaslik for a period of 60 years.

Owing to financial difficulties and to inflated business conditions a great many metal firms—dealers, smelters, and rollers—have collapsed in Germany in recent weeks and had to discontinue operations or to undergo a contraction of trading activities.

Michigan Copper Shipments

A total of 10,436,000 lb. of copper was shipped by boat out of the Michigan district in October. Calumet & Hecla Consolidated shipped 6,534,000 lb. from the Hubbell smelter. A total of 3,838,000 lb., representing Copper Range, Mohawk, and Isle Royale production, was loaded at the Michigan smelter dock at Houghton. Quincy, which is stamping only the ore taken out in development work, shipped only 64,000 lb.

The Riverside Mining Company has been incorporated in Missouri with a capitalization of 4,000 shares of no-par value stock. Address of the company is given as 1727 Empire St., Joplin, Mo. Dircetors and incorporators of the company include T. S. Blakeley, W. A. Rosenthal and James Davidson, all of Joplin; and M. W. Russell, of Kansas City.

Slight Increase in Canadian Talc and Soapstone Production

TALC and soapstone production in Canada during 1927 amounted to 16,521 tons, valued at $236,105, compared with shipments of 15,767 tons, worth $217,195, in 1926.

Ontario's production was made up of talc obtained from deposits near Madoc, Hastings County, and soapstone from the Grace mine, near Vermilion Bay. Quebec shipments were from quarries in Broughton, Leeds, and Thetford townships, and consisted principally of soapstone blocks for use in lining the alkali recovery furnaces of sulphate (kraft) pulp mills. Small shipments of talc were made from two deposits in British Columbia, one on Vancouver Island and the other near Wilmer, Windermere mining division.

Talc or soapstone, ground or unground, imported into Canada during 1927 amounted to 4,907 tons, appraised at $86,858. Exports of refined talc totaled 10,692 tons, worth $125,123.

St. Joe Selling "Bunker Hill" Electrolytic Zinc

ELECTROLYTIC zinc from the Tainton-process plant of the Sullivan Mining Company, jointly controlled by Hecla Mining and Bunker Hill & Sullivan, at Wallace, Idaho, is being sold through the sales department of the St. Joseph Lead Company, 250 Park Ave., New York. The trade name of this product is "Bunker Hill" zinc. Production at present is at the rate of approximately 900 tons per month, though the ultimate productive capacity of the plant, as equipped at present, of 1,500 tons per month will be attained in December.

Analysis of the metal produced to date has averaged 99.99 plus per cent zinc. The company is confident that this grade can be maintained and that a satisfactory market for the product, which brings a premium over other brands of electrolytic zinc, can be developed. Several commercial testing laboratories are making exhaustive tests on "Bunker Hill" zinc to determine its exact physical and chemical properties and to outline probable new industrial fields in which the metal may find utilization.

Nipissing Mines Company, operating in the Cobalt district of Ontario, reports value of silver produced for the three months ending Sept. 30, 1928, as $280,383.

London Financial News

LONDON, OCT. 31, 1928—The Rhodesia Katanga-Junction Railway & Mineral Company has sold, for £975,000, its entire railway assets to the British South Africa ("Chartered") Company. The amount received will enable the company, controlled by Tanganyika Concessions—Sir Robert Williams interests—to redeem its £800·000 of debentures, leaving a handsome surplus as working capital for the mining properties retained. These include the Luano coal area, the Kansanshi gold-copper mine and 2,500 square miles of mineral rights, all in northwest Rhodesia. Work thereon is now to be accelerated, and northern Rhodesia will soon be the scene of operations of another active exploration company.

Tin continues in the throes of the fight between "bulls" and "bears," the one represented by the Anglo-Oriental group of tin-mining companies, and the other by the chief tin merchant house, Ricard & Freiwald. Though the former does not admit the heavy purchases of metal attributed to it during recent weeks, reports are that as much as 2,000 tons has been taken off the market by the group since it started buying the metal in the last "bull" movement. Certainly few other houses would enjoy the resources to finance purchases on such a scale; and no other group could benefit from tactics of this nature. Much propaganda (unquestionably emanating from "bull" interests) is being indulged in, and every use is being made in this way of instances of decreased output from one source or other.

The annual report of Nigeria's second largest producer, the Northern Nigeria (Bauchi) Tin Company, is illuminating in that it removes in at least one instance the erroneous belief that the present price of tin is unremunerative to Nigerian dredging companies. Bauchi produced 1,710 tons of concentrate in the year to June 30 last, realizing £309,376, or £180 per ton. Mining, freight, smelting, royalty, and head-office charges, together with depreciation and prospecting, amounted to £171,230, or roughly £100 per ton of concentrate, leaving a margin of £80 per ton, out of which £114,200 was distributed in dividends, ordinary shareholders receiving 50 per cent. Ore reserves contain 7,170 tons of black tin, providing over four years' life at the present rate, and "substantial augmentation" of these reserves is expected by the management.

Potgietersrust Platinums, Ltd., has not yet decided which of the three concentrate treatment processes it will eventually employ. In a quarterly progress report the company states that all are under consideration, that the choice rests on a matter of economics, but that all three are sufficiently advanced as to "eliminate any risk in proceeding with the reduction plant at once." The first unit of this is now to be erected. It will have a monthly capacity of 6,000 tons, and an over-all extraction of 80 per cent. With ores containing 9 dwt. of platinum-group metals per ton, the annual output from this mine will be some 26,000 oz. of platinum metals.

Much disappointment is felt at the annual report of the Gaika Gold Mining Company (Southern Rhodesia), for it discloses a position far removed from the optimistic outlook presented at the last general meeting, and the profit is only £5,475, against £22,183 in 1926-27. No dividend is paid. The exhaustion of accumulated slimes and the much lower grade of ore raised have caused a drop in gold production. Development has not paid for the cost except in one sector of the mine, and has been curtailed, pending the report of C. S. Morgan, of the Rhodesia Geological Survey.

NORTH BUTTE MINING COMPANY receivership has been ended through a decision by Federal Judge Bourquin, of Butte, recently. Officials of the company have stated that approximately $1,000,000 will be remaining for development.

Are We to Have a "Hoover Bull Market"?

FINANCIAL writers have mentioned Tuesday, Nov. 6, 1928, as marking the end of the fourth year of the "Coolidge Bull Market." The need for the adjective is most apparent, however. In fact, if the behavior of the stock market on Wednesday, Nov. 7, following the news of Herbert Hoover's election is any criteria, a "Hoover Bull Market" may result that will dwarf the well-known Coolidge model by comparison.

Just why mining company stocks should surge upward so rampantly is not apparent. Of course, the election of a man with a record of outstanding professional achievement in mining engineering is gratifying to the fraternity, but such a feeling of personal gratitude is not likely to be shared by stock-exchange operators and manipulators. Seemingly, the improvement in the copper-market situation had been amply discounted, but, nevertheless, the day following Mr. Hoover's overwhelming election saw the most generous upward movement of the year in mining-company stocks. Anaconda shares advanced $5.875 per share, Kennecott $12, and Chile Copper $5.375. These three advances, alone, resulted in an increase in the combined stock-market valuation of the three companies by approximately $100,000,000. The drawing of further conclusions concerning a "Hoover Bull Market" may best be accomplished with more data, but if the first day is any indication—our readers may rely on their own imaginations for descriptive possibilities.

October Copper Statistics

OCTOBER copper statistics released by the A.B.M.S. on Nov. 13 occasioned much interest within the industry. A few of the more interesting and pertinent figures from this release are enumerated here. (All figures represent short tons.)

Primary Production of United States Mines (1928)

	August	September	October
Porphyry mines	33,201	33,992	38,740
Lake mines	7,307	6,847	8,221
Vein mines	32,539	32,748	34,640
Custom ores	3,905	3,498	(a) 4,200
Totals	76,952	77,085	85,801

(a) Partly estimated.

October production of 85,801 tons is at the rate of 2,768 tons per day, a new record. Average 1926 daily rate was 2,309 tons, 2,274 tons for 1927, and 2,414 tons for the first ten months of 1928. A summary of North and South American production data follows (1928):

	April	September	October
Blister, North America	90,564	95,102	110,618
Blister, South America	(a) 26,228	30,674	33,643
Refined, North and South America	122,824	137,018	149,199

(a) Includes refined copper from Braden and Chile.

The trend of North and South American copper stocks during various months of the past year is indicated in the accompanying tabulation:

Stocks

	Blister (Including "in Process")	Refined	Total
October, 1928	257,604	45,648	303,252
September, 1928	255,727	51,812	307,539
July, 1928	257,673	54,871	312,544
December, 1927	247,337	95,298	342,635

The increase in shipments which took place in order to effect the decline in stocks despite the large increase in production is indicated in the following tabulation:

Shipments

(1928)	Export	Domestic	Total
January	56,721	64,824	121,545
September	51,292	88,707	139,999
October	54,992	100,371	155,363

Different conclusions may be drawn from the foregoing figures by various factors to satisfy individual viewpoints, but the obvious improvement indicated in production and consumption will be apparent to all.

CHIEF CONSOLIDATED MINING COMPANY reports net income of $114,286 during the first nine months of 1928. Walter Fitch, president, states that the passing of dividends in the last two quarters may be continued into future quarters because the company's earnings are being absorbed in a broadened plan of expenditures for development work in its different mines. A considerable proportion of this development work is being concentrated in the properties of the company in the East Tintic district, particularly those adjoining the North Lily and Tintic Standard mines.

The Market Report

Copper, Zinc, Tin, and Silver Steady, With Average Demand

New York, Nov. 14, 1928—No outstanding activity in the non-ferrous metal market has occurred in the week ending today. Though most market followers have considered copper quiet, it has sold in about average volume, with the price unchanged at 16c. per pound for Eastern deliveries. Zinc continues in good demand at 6.25c., also unchanged. Tin and silver have been quiet but firm at around 50 and 58c., respectively. Last Friday, lead recorded a little slump in price, owing to the decline to £21 1s. 9d. in London, but now London has recovered to £21 3s. 9d., so that the immediate possibility of a further decline here seems to have been arrested. Domestic demand for lead did not receive much stimulation from the price cut. The boom in the stock market continues, indicating continued or increased industrial activity during the winter and spring, and a consequent heavy demand for metals.

Daily Prices of Metals

Nov.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
8	15.775	49.875	6.50	6.30	6.25
9	15.775	49.875	6.35	6.20	6.25
10	15.775	49.75	6.35	6.20	6.25
12	15.775	50.00	6.35	6.20	6.25
13	15.775	50.00	6.35	6.20	6.25
14	15.775	50.00	6.35	6.15@6.20	6.25
	15.775	49.917	6.375	6.213	6.25

Average prices for calendar week ending Nov. 10, 1928, are: Copper, 15.775; Straits tin, 49.700; N. Y. lead, 6.440; St. Louis lead, 6.265; zinc, 6.250; and silver, 57.900.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis: that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
8	68 3/16	68 5/8	75	231	224 1/4	21 1/8	21 7/16	24 1/4	24 1/16
9	67 7/8	68 3/8	75	231	224 1/4	21 1/16	21 5/16	24 1/4	24 1/16
12	67 7/8	68 5/16	74 3/4	230 5/8	224 3/8	20 15/16	21 3/16	24 5/16	24 1/8
13	67 15/16	68 3/8	74 3/4	230	225	20 15/16	21 1/4	24 5/16	24 3/8
14	68 3/16	68 9/16	74 3/4	229	223 1/2	21 3/16	21 7/16	24 11/16	24 9/16

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
8	4.84 3/8	57 7/8	26 11/16	84s11½d	12	4.84 3/8	58 1/4	26 3/4	84s11½d
9	4.84 3/8	57 7/8	26 11/16	84s11½d	13	4.84 3/8	58 1/8	26 13/16	84s11½d
10	4.84 3/8	58	26 3/4	.....	14	4.84 3/8	58	26 11/16	84s11½d
					Ave.		58.021		

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Still a Sellers' Market in Copper

The copper situation remains unchanged from a week ago, the chief topic of interest being the statistics of production and stocks released yesterday, which are summarized on page 809. The metal is obtainable from all sellers at 16c. delivered in the Connecticut Valley and 16⅛c. in the Middle West, and the sales, which are of about normal volume, have been shared in by all producers. However, there is a pronounced evidence of a disinclination to book orders in as large tonnage as many consumers would like to secure. About 60 per cent of the demand has been for February shipment, 30 per cent for January, and 10 per cent for December. It is thought that most January requirements have already been purchased, and also about a third of the metal likely to be required for February. Producers are averse to a further advance in price, feeling that it could not be sustained in a dull market; if demand continues on the present modest scale for a few weeks, it seems likely that present prices will be substantially unchanged for the rest of the year.

The foreign market has been quiet so far this month at the unchanged level of 16¼c. c.i.f. A good amount of November remains to be purchased, though the strike in Germany may have a slightly adverse effect on consumption.

Lead Quiet at Lower Prices

Continued decline in the London price of spot lead culminated in a reduction of the A. S. & R. contract price to 6.35c. per pound on Friday, Nov. 9. Though domestic business has been easier in the last three weeks, this price decline was occasioned entirely by the weakness in the London price, which was approaching the level at which foreign bullion might profitably be imported into the United States. Since Friday the London price failed to strengthen, until today, when an advance of 5s. per ton for spot lead returned the London quotation to a higher level than that prevailing at the time of the price reduction here. Business has been approximately 50 per cent of normal during the last week. In the St. Louis market particularly there has been marked inactivity. Today producers of chemical lead are somewhat at variance as to their idea of the St. Louis price; one large interest has no metal to sell below 6.20c. per pound, though other factors offer lead at 6.15c. in St. Louis, and there is some indication that 6.175c. might be done in other

directions. Virtually all of the sales consummated during the last week have been for prompt or near-by delivery.

A.B.M.S. statistics released today indicate United States and Mexican production of crude lead in October at 80,575 tons, against 75,092 tons in September and 74,979 tons in August. Stocks of refined lead declined from 52,381 tons at the end of August, and 46,850 tons on Sept. 30, to 41,495 tons at the end of October.

Galvanizers Active

The galvanizing business seems to be rather active just now, and for the fourth successive week a good tonnage of zinc has been sold, though nothing phenomenal. Deliveries vary from prompt to as far forward as March, all being quoted at 6.25c., St. Louis, as has been the case for many weeks.

Statistics released by the American Zinc Institute, for October, in tons of 2,000 lb., follow:

Stock Oct. 1	47,915
Produced	50,259
Shipped	52,106
Stock Oct. 31	46,068
Shipped from plants for export	1,980
Metal sold, not yet delivered, Oct. 31	19,522
Total retort capacity, Oct. 31	116,126
Number of idle retorts available within 60 days	50,300
Average number of retorts operating in October	63,103
Number of retorts operating Oct. 31	59,832

The average price of 10,255 tons of Prime Western zinc sold for October delivery was given as 6.256c., and of 10,850 tons for later delivery, 6.249c. Brass Special was 6.372c. and 6.365c. respectively.

Price Firmness Feature of Tin Market

Consumer business has been normal in the tin market during the last week. Prices, however, have shown a remarkable firmness, with a net advance of ¼c. per pound during the week. The general situation remains uncertain, with the movements of the Anglo-Oriential group in London closely watched by all interests in the trade.

Silver Quiet but Steady

The silver market has continued quiet during the last week and only unimportant fluctuations in price have taken place. China has been a moderate buyer, and a few orders have been received from India. The undercurrent is steady.

Mexican Dollars (Old Mexican pesos): Nov. 8th, and 9th, 43¾c.; 10th, 43⅞c.; 12th, 44⅛c.; 13th, 44c.; 14th, 43⅞c.

Foreign Exchanges Quiet

Foreign exchanges have been generally quiet lately. Closing cable quotations on Tuesday, Nov. 13, were as follows: Francs, 3.90 19/32c.; lire, 5.23 15/16c.; and marks, 23.815c. Canadian dollars, 7/64 of 1 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb., duty paid, New York: Chinese brands, 10¼c. per lb. for spot, 10⅛@10c. per lb. for futures. Cookson's "C" grade, spot, 15⅜c.

BISMUTH—Per lb., New York, in ton lots, $1.70. Smaller lots, $1.85 and up.

CADMIUM — Per lb., New York: 70@95c. Market continues active with the lower price obtaining on contract business to old customers. Spot sales of odd lots command 85 to 95c.

IRIDIUM — Per oz., $280@$300 for 98@99 per cent sponge and powder.

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 37c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $42@$46. Small lots bring up to $50. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $76, reduced from $78 per oz. on Nov. 8. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $72@$73 bid, $73@$75 asked. Quiet.

QUICKSILVER — Per 76-lb. flask, $123, cash. Small lots command the usual premiums. Market is very quiet at present. European offerings are reported as a depressing factor in the domestic market.

Prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium are unchanged from the issue of Nov. 3.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $11; Western scheelite, $11.50. Nominal.

Chrome, Iron, Manganese, Tantalum, Titanium and Vanadium ores are unchanged from quotations in the Nov. 3 issue.

Joplin Shipments Absorbing Production

Joplin, Mo., Nov. 10, 1928

Blende	Per Ton
High	$42.55
Premium blende, basis 60 per cent zinc	$40.00@ 41.00
Prime Western, basis 60 per cent zinc	39.00@ 40.00
Fines and slimes, 60 per cent zinc	34.00@ 36.00
Average settling price, all zinc	39.53
Galena	
High	$87.80
Basis 80 per cent lead	85.00
Average settling price, all lead	84.44

Shipments for the week: Blende, 12,523; lead, 1,985 tons.

Last week the shipment was slightly less than the output of zinc concentrate, but this week 1,000 tons more were shipped than produced. Reserve stock in bins is held by financially strong interests, and although it is for sale as needed by the smelters, no producer has had to make a forced sale at a sacrifice price, and it now appears certain no such an emergency need develop.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Nov. 3 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Only an occasional carload now being sold.

COPPER SULPHATE (Blue Vitriol)—Per lb. in carload lots 5½c.

Antimony Oxide, Calcium Molybdate, Sodium Sulphate (Salt Cake), Sodium Nitrate, and Zinc Oxide are unchanged from prices in the Nov. 3 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105 quoted for last half, 1928. Spiegeleisen, 19@21 per cent, $33 f.o.b. furnace.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon. Ferrotitanium, Ferrotungsten, Ferrovanadium, Monel Metal, Nickel Silver and Yellow (Muntz) Metal, are unchanged from prices in the Nov. 3 issue.

Rolled Metals

Copper, Lead and Zinc Sheets are unchanged from prices in the Nov. 3 issue.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Nov. 3.

Iron, Steel, and Coke

Iron—Per gross ton, Valley furnaces, Bessemer, $18; basic, $18; No. 2 foundry, $18.

Steel—Base prices per gross ton, Pittsburgh, billets and slabs, $33@$34; plates, structural shapes, and soft steel bars, per lb., 1.90@2c.

Coke—Per gross ton, Connellsville furnace, $2.90@$3. Connellsville foundry, $3.75@$4.85. By-product coke, Ohio and Kentucky, $7; Buffalo and Detroit, $8.50@$9.

Mining Stocks—Week Ended November 10, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	97⅜	88	96½	Oc.13, No. 19 Q	1.00
Ariz. Com'l	Boston	5	4⅛	5	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz	New York	124⅛	115	120⅜	Se. 7, Se. 24 Q	1.50
Calumet & Hecla	Boston	47	42¼	46	No. 30, De.15,Q	1.00
Cerro de Pasco	New York	108⅛	100⅛	105⅛	Oc.11, No. 1 Q	1.25
Chile Copper	New York	64⅜	58⅜	64	De.5 , De.29 Q	0.75
Con. Coppermines	N. Y. Curb	15⅜	13⅜	14⅞		
Copper Range	Boston	26	22⅜	25½	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*26	*23	*25		
East Butte	Boston	5	4	4⅜	Dec., 1919	0.50
Granby Consol	New York	83⅞	77½	81⅛	Oc.11, No.1 Q	1.00
Greene Cananea	New York	152⅛	134	147⅛	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	71	65⅜	69⅛	Se.29, Oc.15, Q	1.00
Inspiration Consol	New York	36⅛	30⅛	35¼	Apr. 1927 Q	0.25
Isle Royale	Boston	26⅛	25½	26	Au.31, Se.15SAX	0.75
Kennecott	New York	140⅛	122⅞	139¼	Au.31, Oc 1 Q	1.50
Magma Copper	New York	66⅜	59⅛	63⅜	Oc.1, Oc.15 Q	0.75
Mason Valley	N. Y. Curb	2⅛	1⅛	1⅞		
Miami Copper	New York	27⅛	25⅛	26⅜	No.1, No.15, Q	0.37½
Mohawk	Boston	46	41	41	Oc. 31, De. 1 Q	3.00
Montana-Idaho	Spokane	*14	*12⅜	*12⅜		
Mother Lode Coal	New York	4	3⅛	3⅞	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	35⅞	30⅛	34⅜	Se.14, Se.29 Q	0.37½
New Cornelia	Boston	46	38	42	No.2, No. 19 Q	0.50
Noranda	N. Y. Curb	57	53⅛	55⅞		
North Butte	Boston	6	4⅛	6	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*79	*72	*75	Sept., 1926	0.03
Old Dominion	Boston	16	13⅜	15⅛	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	197	190	194	Se.10, Oc.1 Q	2.00
Quincy	Boston	40⅛	37	40	March, 1920	1.00
St. Mary's Min. Ld	Boston	37⅛	34⅛	37	Ap.1928 A	2.00
Seneca Copper	New York	7	5⅜	6⅛		
Shattuck-Denn	N. Y. Curb	19	17⅛	18⅞		
Tenn. C. & C	New York	17⅞	16⅛	17⅛	Au., 31 Se.15,Q	0.25
United Verde Ex	N. Y. Curb	24⅛	23⅛	23⅝	Oc.6, No.1 Q	0.50
Utah Copper	New York	250	220	250	Se.14, Se.29 Q	2.00
Utah Metal & T	Boston	1⅛	1⅛	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	2.02½	1.82½	1.97½		
NICKEL-COPPER						
Internat. Nickel	New York	196	186¾	190¾	Se.10, Se.29 Q	0.75
Internat. Nickel pfd	New York	124	122	124	Oc.1, No.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*4⅜	*4⅛	*4⅛	June, 1927	0.005
National Lead	New York	122	120	122	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	142	140½	140½	No.3, De.15 Q	1.75
National Lead, pfd. B	New York	118	118	118	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	46¼	44⅛	46	Se.8, De.20 QX	0.75
ZINC						
Am. Z. L. & S	New York	49⅛	43⅜	45⅜	May, 1917	1.00
Am. Z. L. & S. pfd	New York	106½	99⅜	99⅜	Nov., 1920	1.50
Butte C. & Z	New York	10⅜	8⅛	10⅛	De., 1926	0.50
Butte & Superior	New York	12⅜	10⅛	10⅞	Se.14,Se.29 Q	0.50
Callahan Zn-Ld	New York	3⅜	3⅛	3⅛	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	10	10	10	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	19	18⅛	19	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	100	100	100	July 15 Q	1.50
Evans-Wallower	N. Y. Curb	13⅞	8⅛	12⅛		
New Jersey Zn	N. Y. Curb	231	228¼	231	No. 20, De. 10 X	2.00
Treadwell-Yukon	Toronto	13.25	12.25	13.00		
United Zinc	N. Y. Curb	*70	*70	*70		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	10	7	10		
Ankerite	Toronto	...	...	*22		
Barry-Hollinger	Toronto	*40	*34	*39½		
Central Manitoba	Toronto	*83	*81	*81		
Cresson Consol. G	N. Y. Curb	*95	*80	*95	Oct. 15, Q	0.02
Dome Mines	New York	8⅜	8⅛	8⅜	Se.29, Oc.20 Q	0.25
Gold Hill	Toronto	*12	*8	*10½		
Golden Cycle	Colo.Springs	†1.63	†1.61	...	My. 31, Je.10 Q	0.04
Hollinger Consol	Toronto	9.25	8.90	9.00	No 14, De. 1 M	0.05
Homestake Mining	New York	79½	79½	79½	No.15, De.1 M	0.50
Kirkland Lake	Toronto	1.15	1.06	1.07		
Lake Shore	Toronto	20.95	19.00	19.25	Se.1, Se.15 XQ	0.20
McIntyre Porcupine	New York	...	...	20⅜	No.1, De.1 Q	0.25
Portland	Colo.Springs	†*15	*†13	....	Ap., 1927	0.02
Rand Mines	New York	...	...	36½	Au.21-28 Am.Sh	1.52
Sylvanite	Toronto	2.35	2.25	2.25		
Teck-Hughes	Toronto	9.00	8.40	8.85	Oc.17, No.1	0.15
Tom Reed	Los Angeles	*51	*40	*49	Dec., 1926	0.02
Tough-Oakes	Toronto	*15	*13	*13½		
Vipond Cons	Toronto	*69	*58	*60	April, 1927	0.03
Wright-Hargreaves	Toronto	2.75	2.50	2.53	Oc.16, No.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	22⅞	22⅛	22⅛		
Con. Cortez	N. Y. Curb	*19	*19	*19		
Dolores Esperanza	N. Y. Curb	*99	*95	*95	July, 1923	0.05
N.Y. Hond'a Rosario	N. Y. Curb	14⅛	14⅛	14⅛	Oc.17, Oc.27 QX	0.50
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	Se.14, Oc.4 Q	0.06
Tonopah Belmont	N. Y. Curb	*75	*75	*75	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*9	*7	*7	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	3⅛	3⅛	3⅛	Se.29,Oc.20 SA	0.07½
West End Consol	N. Y. Curb	...	...	*3	Mar., 1923	0.05
Yukon Gold	Boston Curb	...	...	*65	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*66	*65	*65	May, 1920	0.03
Castle-Trethewey	Toronto	*45	*36	*38		
Coniagas	Toronto	3.00	3.00	3.00	May, 1924	0.12½
Keeley	Toronto	*38	*38	*38	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	...	...	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.20	3.05	3.20	De.6, De.20 SA	0.12½
Nipissing	N. Y. Curb	3	2⅞	3	Se.29, Oc.20 Q	0.07½

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅜	3⅛	3⅜	Ap., 1927	0.12
Bingham Mines	Boston	47⅛	47⅛	47⅛	Se.20, Oc. 5 MX	0.50
Bunker Hill & Sullivan	N. Y. Curb	155	129½	135	Oc.. 31,No. 5 X	0.75
Cardiff M. & M	Salt Lake	*30	*30	*30	Feb. 5, 1927	0.10
Chief Consol	Salt Lake	4.00	3.75	4.00	Ja.10, Fe.1 K	0.10
Consti'n Mng.&Mill'g.	Spokane	*48	*39	*48		
Erupcion	Boston Curb	*30	*24	*30	Ja., 1928 Q	0.07½
Eureka Lily	Salt Lake	1.60	1.55	1.55		
Federal M. & S	New York	172	159	172	Je., 1927	10.00
Federal M. & S. pfd	New York	100	100	100	Au. 24, Se. 15 Q	1.75
Golconda	Spokane	*86	*83	*85		
Hecla Mining	N. Y. Curb	17⅛	16⅛	17⅜	No.15, De.14 Q	0.15
Highland-Surprise	Spokane	*13	*12½	*12⅜		
Iron King Mining	Salt Lake	*95	*91	*91		
Keystone Mining	Salt Lake	†*30	†*20	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*24	*24	*24		
Lucky Tiger-Com	Kansas City	†6.75	†6.50	...	No.4, No.20 M	0.05
Mammoth Mining	Salt Lake	1.25	1.25	1.25	De., 1926	0.25
North Lily	Salt Lake	8.00	7.90	8.00	Oct., 20 I	0.20
Park Utah	New York	11	10⅛	10⅜	Se.,11, Oc.1 Q	0.20
Plutus Mining	Salt Lake	†2.00	†1.25	....	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*49½	*49	*49½	June 15 Q	0.03
Sherman Lead	Spokane	*31	*22½	*28½		
Silver King Coal	Salt Lake	13.37½	13.00	13.25	Se.20, Oc.1 Q	0.25
Silversmith	Spokane	*9⅜	*9	*9⅛	Oct., 1926 Q	0.02
Strattons Mines	Spokane	1.38	1.30	1.30		
Sunshine M. Co	Spokane	1.31	1.30	1.30	June 20, K	0.02
Tamarack-Custer	Spokane	*42½	*40	*42½	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.75	13.50	13.50	Se.19, Se.29 QX	0.30
Utah-Apex	Boston	4	3⅛	3⅛	Jl.14, Au.1 K	0.25
IRON						
Bethlehem Steel	New York	...	...	66	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	142	125	140	Oc.15, Oc.25. Q	1.00
Colorado F & I, pfd	New York	78⅜	70⅛	77⅜	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	29½	28⅛	29⅜	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	74	70⅞	74	No. 15, De.1 Q	0.62½
Republic I. & S	New York	84⅜	76⅛	84⅛	No. 14, De. 1 Q	1.00
Republic I. & S. pfd	New York	110	108	110	De. 14, Ja. 2 Q	1.75
Sloss-Sheffield S. & I	New York	118	117⅜	118	Se.10, Se.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	....	....	104⅛	Se. 20, Oc. 1 Q	1.75
U. S. Steel	New York	165⅜	160⅜	164⅜	No.30, De.29 Q	1.75
U. S. Steel, pfd	New York	141⅞	141	141	No. 3, No.28 Q	1.75
Virginia I. C. & C	New York	....	....	25⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	49⅛	49⅛	49⅛	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	...	...	24⅛	Ju.16, Ju.26 K	0.97
So. Am. G. & P	N. Y. Curb	3⅛	3⅛	3⅛		
Alum. Co. of Amer	N. Y. Curb	138⅛	137	137⅛		
Alum. Co. of Amer. pf.	N. Y. Curb	107	107	107	Se. 15, Oc. 1 Q	1.75
Vanadium Corp	New York	108	84⅜	103	De.1,De. 15 QX	1.75
Patino M. & E	New York	36⅜	34½	35⅜	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	22⅛	21⅛	21⅛	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	77⅛	75	77	Se.29, Oc 15 Q	1.75
SULPHUR						
Freeport Texas	New York	49⅛	45⅜	49	Oc.15, No.1 QX	1.25
Texas Gulf	New York	76⅛	69⅞	76⅛	Se. 1⅛, Se 15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	52⅜	49⅜	50⅛	No. 20, De 1 Q	0.75
Amer. Metal, pfd. 6%	New York	113	112	113	No. 20, De.1 Q	1.50
Amer. Sm. & Ref	New York	276½	265⅛	275⅛	Oc.11, No.1 Q	2.00
Amer. Sm. & Ref. pfd.	New York	138	137	138	No.2, De. 1 Q	1.75
Consol. M. & S	Montreal	295	289	295	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	196⅜	183½	191¼	Se.28, Oc.15 Q	1.00
U. S. Sm. R. & M	New York	60	56⅛	58⅛	Oc.5, Oc. 15 Q	0.87½
U.S. Sm. R.&M. pfd	New York	54	53⅛	54	Oc. 5, Oc. 15 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED October 31, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	21/3	18/9	20/—			
Alaska Treadwell ($25)	120/—	119/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	58/9	58/1½	58/9	Aug, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/7½	14/1½	14/3	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	8/3	7/6	8/1½			
Camp Bird (2s)	4/—	3/6	3/10½	April, 1928	16⅔ p.c.	
El Oro (£1)	5/—	4/7½	5/—	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	8/9	8/6	8/9	July 1928	3½ p.c.	
Mexican Corpn. (£1)	10/6	9/3	10/3			
Mexico Mines of El Oro (£1)	32/—	27/6	30/—	Dec., 1926	3½ p.c.*	
Mond Nickel	138/1½	126/3	133/9	Aug., 1928	20 p.c.	
Mount Isa (£1)	35/—	33/1½	33/9			
N'Changa Copper Mining	20/3	19/3	20/—			
Oroville Dredging (£1)	3/9	3/6	3/9	Dec., 1923	3½ p.c.	
Rhodesian Congo Border (£1)	34/6	31/3	32/6			
St. John del Rey (£1)	12/6	11/6	12/3	April, 1928	7½ p.c.	
San Francisco Mines (10s)	29/9	28/3	29/6	July 1928	12½ p.c.	
Santa Gertrudis (£1)	15/1½	14/1½	14/4½	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	8/4½	7/6	7/9	April, 1917	6¾ p.c.	
S. Amer. Copper (2s.)	2/4½	2/1½	2/1½	Nov., 1917	75 p.c.	
Tanganyika (£1)	64/—	60/—	62/6	July 1928	5 p.c.	
Union Miniere du Haut-Katanga (Brussels)	11,300	10,900	11,300	July, 1928	182.60 (b)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation.